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ABSTRACT

This Unified Sciences and Mathematics for Elementary Schools (USMES) unit challenges students to determine the best information to use to quickly and easily identify an individual. The challenge is general enough to apply to many problem-solving situations in mathematics, science, social science, and language arts at any elementary school level (grades 1-8). The Teacher Resource Book for the unit is divided into five sections. Section I describes the USMES approach to student-initiated investigations of real problems, including a discussion of the nature of USMES "challenges." Section II provides an overview of possible student activities with comments on prerequisite skills, instructional strategies, suggestions when using the unit with primary grades, a flow chart illustrating how investigations evolve from students' discussions of describing people problems, and a hypothetical account of fourth-grade class activities. Section III provides documented events of actual class activities from grades 1/2 and 3. Section IV includes lists of "How To" cards and background papers, bibliography of non-USMES materials, and a glossary. Section V consists of charts identifying skills, concepts, processes, and areas of study learned as students become involved with describing people activities. (JN)

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USMES

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Describing People

Fifth Edition

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~~Brenda~~ Brend
Short hair
Dark hair
small
thin
green eyes
short nose
small mouth
small eres
short finger nails
green tites
red Dress with flowers.
dirty house keeper

Jenny

SE 039 066

Teacher Resource Book

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UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS:
Mathematics and the Natural, Social, and Communications Sciences in Real Problem Solving.

Describing People

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CHALLENGE: DETERMINE THE BEST INFORMATION TO PUT IN A DESCRIPTION SO THAT A PERSON CAN BE QUICKLY AND EASILY IDENTIFIED.

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Preface

The USMES Project

Unified Sciences and Mathematics for Elementary Schools: Mathematics and the Natural, Social, and Communications Sciences in Real Problem Solving (USMES) was formed in response to the recommendations of the 1967 Cambridge Conference on the Correlation of Science and Mathematics in the Schools.* Since its inception in 1970, USMES has been funded by the National Science Foundation to develop and carry out field trials of interdisciplinary units centered on long-range investigations of real and practical problems (or "challenges") taken from the local school/community environment. School planners can use these units to design a flexible curriculum for grades one through eight in which real problem solving plays an important role.

Development and field trials were carried out by teachers and students in the classroom with the assistance of university specialists at workshops and at occasional other meetings. The work was coordinated by a staff at the Education Development Center in Newton, Massachusetts. In addition, the staff at EDC coordinated implementation programs involving schools, districts, and colleges that are carrying out local USMES implementation programs for teachers and schools in their area.

Trial editions of the following units are currently available:

- Advertising
- Bicycle Transportation
- Classroom Design
- Classroom Management
- Consumer Research
- Describing People
- Designing for Human Proportions
- #Design Lab Design
- #Eating in School
- Getting There
- Growing Plants
- Manufacturing
- Mass Communications
- Nature Trails
- Orientation
- Pedestrian Crossings
- Play Area Design and Use
- Protecting Property
- #School Rules
- School Supplies
- School Zoo
- Soft Drink Design
- Traffic Flow
- #Using Free Time
- Ways to Learn/Teach
- Weather Predictions

*See *Goals for the Correlation of Elementary Science and Mathematics*, Houghton Mifflin Co., Boston, 1969.

#Available fall 1976.

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USMES Resources

In responding to a long-range challenge, the students and teachers often have need of a wide range of resources. In fact, all of the people and materials in the school and community are important resources for USMES activities. USMES provides resources in addition to these. One resource for students is the Design Lab or its classroom equivalent: using the tools and supplies available, children can follow through on their ideas by constructing measuring tools, testing apparatus, models, etc. Another resource for students is the *"How To" Cards*. Each set of cards gives information about a specific problem; the students use a set only when they want help on that particular problem.

Several types of resources are available for teachers: the *USMES Guide*, a *Teacher Resource Book* for each challenge, *Background Papers*, a *Design Lab Manual*, and a *Curriculum Correlation Guide*. A complete set of all these written materials comprise what is called the USMES library. This library, which should be available in each school using USMES units, contains the following:

1. *The USMES Guide*

   The USMES Guide is a compilation of materials that may be used for long-range planning of a curriculum that incorporates the USMES program. In addition to basic information about the project, the challenges, and related materials, it contains charts assessing the strengths of the various challenges in terms of their possible subject area content.

2. *Teacher Resource Books* (one for each challenge)

   Each book contains a description of the USMES approach to real problem-solving activities, general information about the particular unit, edited logs of class activities, other written materials relevant to the unit, and charts that indicate the basic skills, processes, and areas of study that may be learned and utilized as students become engaged in certain possible activities.

3. *Design Lab Manual*

   This contains sections on the style of Design Lab activities, safety considerations, and an inventory

of tools and supplies. Because many "hands-on" activities may take place in the classroom, the Design Lab Manual should be made available to each USMES teacher.

4. *"How To" Cards*

   These short sets of cards provide information to students about specific problems that may arise during USMES units. Particular computation, graphing, and construction problems are discussed. A complete list of the "How To" Cards can be found in the USMES Guide.

5. *Background Papers*

   These papers are written to provide information for the teachers on technical problems that might arise as students carry on various investigations. A complete list of the Background Papers can be found in the USMES Guide.

6. *Curriculum Correlation Guide*

   This volume is intended to coordinate other curriculum materials with the Teacher Resource Books and to provide the teacher with the means to integrate USMES easily into other school activities and lessons.

The preceding materials are described in brief in the USMES brochure, which can be used by teachers and administrators to disseminate information about the program to the local community. A variety of other dissemination and implementation materials are also available for individuals and groups involved in local implementation programs. They include *Preparing People for USMES: An Implementation Resource Book*, the USMES slide/tape show, the Design Lab slide/tape show, the Design Lab brochure, the USMES newsletter, videotapes of classroom activities, a general report on evaluation results, a map showing the locations of schools conducting local implementation of USMES, a list of experienced USMES teachers and university consultants, and newspaper and magazine articles.

Acknowledgments

Besides the contributors listed at the beginning of the book, we are deeply indebted to the many elementary school

children whose investigations of the challenge form the basis for this book. Without their efforts this book would not have been possible. Many thanks to the Planning Committee for their years of service and advice. Many thanks also to other members of the USMES staff for their suggestions and advice and for their help in staffing and organizing the development workshops. Special thanks also go to Christopher Hale for his efforts as Project Manager during the development of this book.

* * *

Because Tri-Wall was the only readily available brand of three-layered cardboard at the time the project began, USMES has used it at workshops and in schools; consequently, references to Tri-Wall can be found throughout the Teacher Resource Books. The addresses of companies that supply three-layered cardboard can be found in the Design Lab Manual.

Introduction

Using the Teacher Resource Book

When teachers try a new curriculum for the first time, they need to understand the philosophy behind the curriculum. The USMES approach to student-initiated investigations of real problems is outlined in section A of this Teacher Resource Book.

Section B starts with a brief overview of possible student activities arising from the challenge; comments on prerequisite skills are included. Following that is a discussion of the classroom strategy for USMES real problem-solving activities, including introduction of the challenge, student activity, resources, and Design Lab use. Subsequent pages include a description of the use of the unit in primary grades, a flow chart and a composite log that indicate the range of possible student work, and a list of questions that the teacher may find useful for focusing the students' activities on the challenge.

Because students initiate all the activities in response to the challenge and because the work of one class may differ from that undertaken by other classes, teachers familiar with USMES need to read only sections A and B before introducing the challenge to students.

Section C of this book is the documentation section. These edited teachers' logs show the variety of ways in which students in different classes have worked at finding a solution to the challenge.

Section D contains a list of the titles of relevant sets of "How To" Cards and brief descriptions of the Background Papers pertaining to the unit. Also included in section D is a glossary of the terms used in the Teacher Resource Book and an annotated bibliography.

Section E contains charts that indicate the comparative strengths of the unit in terms of real problem solving, mathematics, science, social science, and language arts. It also contains a list of explicit examples of real problem solving and other subject area skills, processes, and areas of study learned and utilized in the unit. These charts and lists are based on documentation of activities that have taken place in USMES classes. Knowing ahead of time which basic skills and processes are likely to be utilized, teachers can postpone teaching that part of their regular program until later in the year. At that time students can study them in the usual way if they have not already learned them as part of their USMES activities.

A. Real Problem Solving and USMES

*If life were of such a constant nature that there were only a few chores to do and they were done over and over in exactly the same way, the case for knowing how to solve problems would not be so compelling. All one would have to do would be to learn how to do the few jobs at the outset. From then on he could rely on memory and habit. Fortunately--or unfortunately depending upon one's point of view--life is not simple and unchanging. Rather it is changing so rapidly that about all we can predict is that things will be different in the future. In such a world the ability to adjust and to solve one's problems is of paramount importance.**

Real Problem Solving

USMES is based on the beliefs that real problem solving is an important skill to be learned and that many math, science, social science, and language arts skills may be learned more quickly and easily within the context of student investigations of real problems. Real problem solving, as exemplified by USMES, implies a style of education which involves students in investigating and solving real problems. It provides the bridge between the abstractions of the school curriculum and the world of the student. Each USMES unit presents a problem in the form of a challenge that is interesting to children because it is both real and practical. The problem is real in several respects: (1) the problem applies to some aspect of student life in the school or community, (2) a solution is needed and not presently known, at least for the particular case in question, (3) the students must consider the entire situation with all the accompanying variables and complexities, and (4) the problem is such that the work done by the students can lead to some improvement in the situation. This expectation of useful accomplishment provides the motivation for children to carry out the comprehensive investigations needed to find some solution to the challenge.

The level at which the children approach the problems, the investigations that they carry out, and the solutions

*Kenneth B. Henderson and Robert E. Pingry, "Problem-Solving in Mathematics," in *The Learning of Mathematics: Its Theory and Practice,* Twenty-first Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: The Council, 1953), p. 233.

that they devise may vary according to the age and ability of the children. However, real problem solving involves them, at some level, in all aspects of the problem-solving process: definition of the problem; determination of the important factors in the problem; observation; measurement; collection of data; analysis of the data using graphs, charts, statistics, or whatever means the students can find; discussion; formulation and trial of suggested solutions; clarification of values; decision making; and communications of findings to others. In addition, students become more inquisitive, more cooperative in working with others, more critical in their thinking, more self-reliant, and more interested in helping to improve social conditions.

The USMES Approach

To learn the process of real problem solving, the students must encounter, formulate, and find some solution to complete and realistic problems. The students themselves, not the teacher, must analyze the problem, choose the variables that should be investigated, search out the facts, and judge the correctness of their hypotheses and conclusions. In real problem-solving activities, the teacher acts as a coordinator and collaborator, not an authoritative answer-giver.

The problem is first reworded by students in specific terms that apply to their school or community, and the various aspects of the problem are discussed by the class. The students then suggest approaches to the problem and set priorities for the investigations they plan to carry out. A typical USMES class consists of several groups working on different aspects of the problem. As the groups report periodically to the class on their progress, new directions are identified and new task forces are formed as needed. Thus, work on an USMES challenge provides students with a "discovery-learning" or "action-oriented" experience.

Real problem solving does not rely solely on the discovery-learning concept. In the real world people have access to certain facts and techniques when they recognize the need for them. The same should be true in the classroom. When the students find that certain facts and skills are necessary for continuing their investigation, they learn willingly and quickly in a more directed way to acquire these facts and skills. Consequently, the students should have available different resources that they may use as they recognize the need for them, but they should still be left with a wide scope to explore their own ideas and methods.

Certain information on specific skills is provided by the sets of USMES "How To" Cards. The students are referred only to the set for which they have clearly identified a need and only when they are unable to proceed on their own. Each "How To" Cards title clearly indicates the skill involved--"How to Use a Stopwatch," "How to Make a Bar Graph Picture of Your Data," etc. (A complete list of the "How To" Cards can be found in Chapter IX of the USMES Guide.)

Another resource provided by USMES is the Design Lab or its classroom equivalent. The Design Lab provides a central location for tools and materials where devices may be constructed and tested without appreciably disrupting other classroom activities. Ideally, it is a separate room with space for all necessary supplies and equipment and work space for the children. However, it may be as small as a corner of the classroom and may contain only a few tools and supplies. Since the benefits of real problem solving can be obtained by the students only if they have a means to follow up their ideas, the availability of a Design Lab can be a very important asset.

Optimally, the operation of the school's Design Lab should be such as to make it available to the students whenever they need it. It should be as free as possible from set scheduling or programming. The students use the Design Lab to try out their own ideas and/or to design, construct, test, and improve many devices initiated by their responses to the USMES challenges. While this optimum operation of the Design Lab may not always be possible due to various limitations, "hands-on" activities may take place in the classroom even though a Design Lab may not be available. (A detailed discussion of the Design Lab can be found in Chapter VI of the USMES Guide, while a complete list of "How To" Cards covering such Design Lab skills as sawing, gluing, nailing, soldering, is contained in Chapter IX.)

Work on all USMES challenges is not only sufficiently complex to require the collaboration of the whole class but also diverse enough to enable each student to contribute according to his/her interest and ability. However, it should be noted that if fewer than ten to twelve students from the class are carrying out the investigation of a unit challenge, the extent of their discovery and learning can be expected to be less than if more members of the class are involved. While it is possible for a class to work on two related units at the same time, in many classes the students progress better with just one.

The amount of time spent each week working on an USMES challenge is crucial to a successful resolution of the

problem. Each challenge is designed so that the various investigations will take from thirty to forty-five hours, depending on the age of the children, before some solution to the problem is found and some action is taken on the results of the investigations. Unless sessions are held at least two or three times a week, it is difficult for the children to maintain their interest and momentum and to become involved intensively with the challenge. The length of each session depends upon the age level of the children and the nature of the challenge. For example, children in the primary grades may proceed better by working on the challenge more frequently for shorter periods of time, perhaps fifteen to twenty minutes, while older children may proceed better by working less frequently for much longer periods of time.

Student interest and the overall accomplishments of the class in finding and implementing solutions to the challenge indicate when the class's general participation in unit activities should end. (Premature discontinuance of work on a specific challenge is often due more to waning interest on the part of the teacher than to that of the students.) However, some students may continue work on a voluntary basis on one problem, while the others begin to identify possible approaches to another USMES challenge.

Importance of the Challenge

Although individual (or group) discovery and student initiation of investigations is the process in USMES units, this does not imply the constant encouragement of random activity. Random activity has an important place in children's learning, and opportunities for it should be made available at various times. During USMES activities, however, it is believed that children learn to solve real problems only when their efforts are focused on finding some solution to the real and practical problem presented in the USMES challenge. It has been found that students are motivated to overcome many difficulties and frustrations in their efforts to achieve the goal of effecting some change or at least of providing some useful information to others. Because the children's commitment to finding a solution to the challenge is one of the keys to successful USMES work, it is extremely important that the challenge be introduced so that it is accepted by the class as an important problem to which they are willing to devote a considerable amount of time.

The challenge not only motivates the children by stating the problem but also provides them with a criterion for judging their results. This criterion--if it works, it's right (or if it helps us find an answer to our problem, it's

a good thing to do)--gives the children's ideas and results a meaning within the context of their goal. Many teachers have found this concept to be a valuable strategy that not only allows the teacher to respond positively to all of the children's ideas but also helps the children themselves to judge the value of their efforts.

Role of the Teacher

With all of the above in mind, it can be said that the teacher's responsibility in the USMES strategy for open classroom activities is as follows:

1. Introduce the challenge in a meaningful way that not only allows the children to relate it to their particular situation but also opens up various avenues of approach.

2. Act as a coordinator and collaborator. Assist, not direct, individuals or groups of students as they investigate different aspects of the problem.

3. Hold USMES sessions at least two or three times a week so that the children have a chance to become involved in the challenge and carry out comprehensive investigations.

4. Provide the tools and supplies necessary for initial hands-on work in the classroom or make arrangements for the children to work in the Design Lab.

5. Be patient in letting the children make their own mistakes and find their own way. Offer assistance or point out sources of help for specific information (such as the "How To" Cards) only when the children become frustrated in their approach to the problem. Conduct skill sessions as necessary.

6. Provide frequent opportunities for group reports and student exchanges of ideas in class discussions. In most cases, students will, by their own critical examination of the procedures they have used, improve or set new directions in their investigations.

7. If necessary, ask appropriate questions to stimulate the students' thinking so that they will make more extensive and comprehensive investigations or analyses of their data.

8. Make sure that a sufficient number of students (usually ten to twelve) are working on the challenge so that activities do not become fragmented or stall.

Student success in USMES unit activities is indicated by the progress they make in finding some solution to the challenge, not by following a particular line of investigation nor by obtaining specified results. The teacher's role in the USMES strategy is to provide a classroom atmosphere in which all students can, in their own way, search out some solution to the challenge.

USMES in the Total School Program

Today many leading educators feel that real problem solving (under different names) is an important skill to be learned. In this mode of learning particular emphasis is placed on developing skills to deal with real problems rather than the skills needed to obtain "correct" answers to contrived problems. Because of this and because of the interdisciplinary nature of both the problems and the resultant investigations, USMES is ideal for use as an important part of the elementary school program. Much of the time normally spent in the class on the traditional approaches to math, science, social science, and language arts skills can be safely assigned to USMES activities. In fact, as much as one-fourth to one-third of the total school program might be allotted to work on USMES challenges. Teachers who have worked with USMES for several years have each succeeding year successfully assigned to USMES activities the learning of a greater number of traditional skills. In addition, reports have indicated that students retain for a long time the skills and concepts learned and practiced during USMES activities. Therefore, the time normally spent in reinforcing required skills can be greatly reduced if these skills are learned and practiced in the context of real problem solving.

Because real problem-solving activities cannot possibly cover all the skills and concepts in the major subject areas, other curricula as well as other learning modes (such as "lecture method," "individual study topics," or programmed instruction) need to be used in conjunction with USMES in an optimal education program. However, the other

instruction will be enhanced by the skills, motivation, and understanding provided by real problem solving, and, in some cases, work on an USMES challenge provides the context within which the skills and concepts of the major subject areas find application.

In order for real problem solving taught by USMES to have an optimal value in the school program, class time should be apportioned with reason and forethought, and the sequence of challenges investigated by students during their years in elementary school should involve them in a variety of skills and processes. Because all activities are initiated by students in response to the challenge, it is impossible to state unequivocally which activities will take place. However, it is possible to use the documentation of activities that have taken place in USMES trial classes to schedule instruction on the specific skills and processes required by the school system. Teachers can postpone the traditional way of teaching the skills that might come up in work on an USMES challenge until later in the year. At that time students can learn the required skills in the usual way if they have not already learned them during their USMES activities.

These basic skills, processes, and areas of study are listed in charts and lists contained in each Teacher Resource Book. A teacher can use these charts to decide on an overall allocation of class time between USMES and traditional learning in the major subject disciplines. Examples of individual skills and processes are also given so that the teacher can see beforehand which skills a student may encounter during the course of his investigations. These charts and lists may be found in section E.

Ways In Which USMES Differs From Other Curricula

As the foregoing indicates, USMES differs significantly from other curricula. Real problem solving develops the problem-solving ability of students and does it in a way (learning-by-doing) that leads to a full understanding of the process. Because of the following differences, some teacher preparation is necessary. Some teachers may have been introduced by other projects to several of the following new developments in education, but few teachers have integrated all of them into the new style of teaching and learning that real problem solving involves.

1. <u>New Area of Learning</u>--Real problem solving is a new area of learning, not just a new approach or a new content within an already-defined subject area. Although many subject-matter curricula

include something called problem solving, much of this problem solving involves contrived problems or fragments of a whole situation and does not require the cognitive skills needed for the investigation of real and practical problems. Learning the cognitive strategy required for real problem solving is different from other kinds of learning.

3. Interdisciplinary Education--Real problem solving integrates the disciplines in a natural way; there is no need to impose a multi-disciplinary structure. Solving real and practical problems requires the application of skills, concepts, and processes from many disciplines. The number and range of disciplines are unrestricted and the importance of each is demonstrated in working toward the solution of practical problems.

3. Student Planning--To learn the process of problem solving, the students themselves, not the teacher, must analyze the problem, choose the variables that should be investigated, search out the facts, and judge the correctness of the hypotheses and conclusions. In real problem-solving activities the teacher acts as a coordinator and collaborator, not as an authoritative source of answers.

4. Learning-by-Doing--Learning-by-doing, or discovery learning as it is sometimes called, comes about naturally in real problem solving since the problems tackled by each class have unique aspects; for example, different lunchrooms or pedestrian crossings have different problems associated with them and, consequently, unique solutions. The challenge, as defined in each situation, provides the focus for the children's hands-on learning experiences, such as collecting real data; constructing measuring instruments, scale models, test equipment, etc.; trying their suggested improvements; and (in some units) preparing reports and presentations of their findings for the proper authorities.

5. Learning Skills and Concepts as Needed--Skills and concepts are learned in real problem solving

as the need for them arises in the context of the work being done, rather than having a situation imposed by the teacher or the textbook being used. Teachers may direct this learning when the need for it arises, or students may search out information themselves from resources provided.

6. Group Work--Progress toward a solution to a real problem usually requires the efforts of groups of students, not just individual students working alone. Although some work may be done individually, the total group effort provides good opportunities for division of labor and exchange of ideas among the groups and individuals. The grouping is flexible and changes in order to meet the needs of the different stages of investigation.

7. Student Choice--Real problem solving offers classes the opportunity to work on problems that are real to them, not just to the adults who prepare the curriculum. In addition, students may choose to investigate particular aspects of the problem according to their interest. The variety of activities ensuing from the challenge allows each student to make some contribution towards the solution of the problem according to his or her ability and to learn specific skills at a time when he or she is ready for that particular intellectual structure.

B. General Papers on Describing People

1. OVERVIEW OF ACTIVITIES

Challenge:

Determine the best information to put in a description so that a person can be quickly and easily identified.

Most children have encountered the problem of trying to find someone in a busy place. Small children, especially, will offer stories of becoming separated from a parent in a store. The children may relate the various ways in which the parent was located, such as having the store manager describe the child over the P.A. system. Other children may relate experiences of trying to find a person using a description provided by someone else, such as trying to find another teacher's student on the playground. Through a discussion the children may realize that an accurate description is a key factor in being able to find the correct person quickly and easily.

After discussing the challenge the class may try to identify a child in the room using a description written either by a child or by the teacher. The usefulness of these descriptions may then be tested by means of the Sit-Down Game. As the name of the game implies, the children must sit down if they do not possess the characteristic that is being stated. If the child being described is the only one left standing when the description has been completed, then the description is judged to be a good one.

During a discussion of the descriptions, the class may note that it was difficult to single out some children because either there were discrepancies in the use of some descriptive terms, such as tall, medium, short for height, or a characteristic had changed from the previous day, such as clothing. The class may agree that some characteristics, such as clothing, are not useful in descriptions, while others need more clarification.

To clarify descriptive terms, the children collect and graph data. The children may measure and weigh their classmates and put the resulting data on histograms. Using the histograms, the children can visually cluster the data into groups and assign descriptive terms, such as tall, medium, and short, to the various groupings. With those characteristics that cannot be measured, such as hair and eye color, the children may collect samples (where possible) and arrange them on a chart or a bar graph and then cluster the samples into easily defined categories. Later as the children make a decision on the best combination of three, four,

or more characteristics to include in a description, the class may draw scatter graphs to investigate possible correlations of different characteristics.

The class may choose to test their improved descriptions by having one child write a description of a child in another class and then having others in the class try to identify him. An analysis of the successful descriptions in terms of characteristics used leads to a solution of the challenge. The class may also investigate other identification problems, such as those of accident victims, missing persons, criminals, and write letters to the appropriate agencies to share their findings.

The children's investigations of people's similarities and differences may lead them to the Designing for Human Proportions challenge. They may also become interested in further examining differences among races and cultures.

Although many of the Describing People activities may require skills and concepts new to the children, there is no need for preliminary work on them because the children can learn them when the need arises. In fact, children learn more quickly and easily when they see a need to learn. Consider counting: whereas children usually learn to count by rote, they can, through USMES, gain a better understanding of counting by learning or practicing it within real contexts. In working on Describing People children also learn and practice graphing, measuring, working with decimals and dividing. Although dividing seems necessary to compare fractions or ratios, primary children can make comparisons graphically; sets of data can also be compared graphically or by subtracting medians (half-way values).

2. CLASSROOM STRATEGY FOR DESCRIBING PEOPLE

Each USMES unit revolves around a challenge--a statement that says, "Solve this problem." The success or failure of the unit depends largely on (1) the relevance of the problem for the students and (2) the process by which they define and accept the challenge. If the children see the problem as a real one, they will be committed to finding a solution; they will have a focus and purpose for their activities. If the students do not think the problem affects them, their attempts at finding solutions will likely be disjointed and cursory.

The challenge as stated in the Describing People book is

general enough to apply to many situations. Students in different classes define and reword the challenge to fit their particular situation. For example, the general unit challenge--Determine the best information to put in a description so that a person can be quickly and easily identified--was restated by one class in terms of determining the best information to put in a description of parents so that the parents could be easily identified at the upcoming PTA meeting.

The Process of Introducing the Challenge

Given that a problem exists, how can a teacher, without being directive, help the students identify the challenge that they will work on as a group? There is no set method because of variations among teachers, classes, and schools and among the USMES units themselves. However, USMES teachers have found that certain general techniques in introducing the challenge are helpful.

One such technique is to turn a discussion of some recent event toward the Describing People challenge. For example, one child may return to class after lunch period complaining that he could not find the correct child when the school secretary sent him to deliver a message. The class may then discuss the secretary's description and offer improved ones..

Noting that the first PTA meeting of the year would be held in a few weeks, one third-grade teacher expressed her doubts of being able to identify all the children's parents. The children drew each of their parents, but because there was no differentiation between figures, the teacher challenged the class to determine the best information to put in a description of their parents so that she could identify them.

Often work on one challenge leads to another. For example, a class may become involved with the Describing People challenge after exploring various body proportions in response to the Designing for Human Proportions challenge. The children may then wish to expand their investigations to other physical characteristics and decide which characteristics should be put in a description. When children encounter a problem that leads to a related USMES challenge, one group of children may begin work on this second challenge while the rest of the class continues with the first challenge. However, there should be at least ten to twelve students

working on any one challenge; otherwise, the children's work may be fragmented or superficial or may break down completely.

The Describing People challenge may also evolve from a discussion of a specific topic being studied by the class. For example, a class may be studying various cultures and become interested in the physical characteristics of people of each culture. Such a study of physical characteristics may eventually lead the children to compare their own characteristics. The teacher may then focus the activities on finding a solution to the Describing People challenge.

Classroom experience has shown that children's progress on the challenge may be poor if the teacher and students do not reach a common understanding of what the challenge is before beginning work on it. Having no shared focus for their work, the children will lack the motivation inherent in working together to solve a real problem. As a result, they may quickly lose interest.

Although one fourth-grade class discussed the Describing People challenge, the children did not view the problem as urgent. The activities that followed were related to the unit, but they were not focused on the challenge. The class examined individual differences, practiced describing each other, and clarified some characteristics, such as hair color and height. The children's interest eventually waned, however, and activities ceased without any resolution of the challenge.

A similar situation occurs if the teacher, rather than insuring that the children have agreed upon a challenge, merely assigns a series of activities. Although the teacher may see how these activities relate to an overall goal, the children may not.

Lacking any focus to their activities, children in one sixth-grade class wrote descriptions, examined individual differences, studied the human bone structure, and experimented with different measuring instruments. By spring, the class was studying the anatomy of a rat.

Initial Work on the Challenge

Once the class has decided to work on the Describing People challenge, USMES sessions should be held several times a week but they need not be rigidly scheduled. When sessions are held after long intervals, students often have difficulty remembering exactly where they were in their investigations and their momentum diminishes. The students may list characteristics that they feel should be included in a description. After several trials of various descriptions the class may note that it is difficult to single out some children because either there are discrepancies in the use of some descriptive terms (e.g., tall, medium, short for height) or a characteristic (e.g., clothing) has changed from the previous day. To clarify descriptive terms, the class breaks into small groups to collect and graph data. As various groups complete their work, their members may join other groups or form new groups to work on additional tasks.

However, if too many groups are formed, work on the challenge can become fragmented. The teacher finds it impossible to be aware of the progress and problems of each group; in addition, the small number of students in each group lessens the chance for varied input and interaction.

Refocusing on the Challenge

As the class works on the Describing People challenge, the children's attention should, from time to time, be refocused on the challenge so that they do not lose sight of their overall goal. Refocusing is particularly important with younger children because they have a shorter attention span. Teachers find it helpful to hold periodic class discussions that include group reports. Such sessions help the students review what they have accomplished and what they still need to do in order to find some solutions to the problem. These discussions also provide an opportunity for students to participate both in evaluating their own work and in exchanging ideas with their classmates. (Another consequence of having too many groups is that not every group can be given enough time to report to the class, thereby increasing the possibility that the children's efforts will overlap unnecessarily.)

After many test trials of descriptions in one first/second-grade class, the children noted that some characteristics were more effective than others in correctly identifying a person. The class then decided to determine the three most effective characteristics to include in a description.

Resources for Work on the Challenge

When the children encounter difficulties during their investigations, an USMES teacher helps out. Instead of giving answers or suggesting specific procedures, the teacher asks open-ended questions that stimulate the students to think more comprehensively and creatively about their work. For example, instead of telling the students why their descriptions failed, a teacher might ask, "Who is tall, medium, or short in our class? How can we find out?" Examples of other nondirective, thought-provoking questions may be found in Section B6 of this resource book.

The teacher may also refer students to the "How To" Cards which provide information about specific skills, such as drawing graphs or analyzing data. If many students, or even the entire class, need help in particular areas, such as using fractions, the teacher should conduct skill sessions as these needs arise. (Background Papers provide teachers with additional information on general topics applicable to most challenges and on specific problems associated with some challenges, such as set theory for Describing People.)

USMES teachers can also assist students by making it possible for them to carry out tasks involving hands-on activities. If the children need to collect data outside of their classroom--at a police station or in other classrooms--the teacher can help with scheduling and supervision.

So that her students could test their descriptions in other classes, one third-grade teacher arranged with other teachers convenient times when her children could come to their rooms. The third graders divided into teams. One team went to another class and wrote a description of a child in that class. Members of the second team then went to that class and tried to identify the child using the first team's description.

If the children's tasks require them to design and construct items, the teacher should make sure that they have access to a Design Lab. Any collection of tools and materials kept in a central location (in part of the classroom, on a portable cart, or in a separate room) can be called a Design Lab. To carry out construction activities in schools without Design Labs, students may scrounge or borrow tools and supplies from parents, local businesses, or other members of the community.

The extent to which any Design Lab is used varies with different classes and different units because the children themselves determine the direction of the investigations and because construction activities are more likely to occur in some units than in others. Most classes pursuing the Describing People challenge seldom required the use of the lab.

Culminating Activities

Student investigations generally continue until the children have agreed upon and implemented some solution to the problem. For example, the students may compare their descriptions with those used by the local Police Department, the Missing Persons Bureau, or the Federal Bureau of Investigation. The children may then choose to write letters to these agencies to share their findings. Some classes may organize a presentation to inform others in the school the best way to describe people.

A first/second-grade class prepared two flow charts showing characteristics in the order they felt to be best for describing a person. The children felt that if anyone came to their room and needed to know how to describe a lost child, they could give him their flow charts.

3. USE OF DESCRIBING PEOPLE IN THE PRIMARY GRADES

Children in the primary grades may make significant progress with the Describing People challenge of determining the best information to include in a description so that a person can be quickly and easily identified. In fact, most of the Describing People trials have occurred at the primary level. Although younger children's entry level to the challenge and their sophistication with the investigation will certainly be different from that of older children, they will be able to propose possible solutions, collect and interpret data, and take action on their challenge.

Experience has shown that small children are always eager to share their experiences. To take advantage of this enthusiasm, a teacher may wait for a child to share a tale about searching for someone before raising the problem of the challenge. For example a child may tell about looking for a friend on the playground and may note that it was difficult at first to find the friend because there were so

many people on the playground. However, because his friend has red hair, the child was eventually able to find him. This and other similar incidents provide a basis for a lively discussion of physical characteristics and the best way to describe someone so that he can be easily found.

The children may write descriptions of their classmates and test them by playing the Sit-Down Game. While playing the game, the children may notice that some terms used to describe hair color, eye color, or height cause considerable disagreement. The class may decide to use certain specific descriptive terms, such as tall, medium, and short for height, and to define each term exactly.

In classes where students have previously worked in small groups, the children may divide the tasks so that each small group investigates one characteristic. With less experienced children the teacher may find it beneficial in the beginning for the whole class to work on one problem at a time. Gradually, as the children become more able to follow through on their proposed plans, the teacher may encourage the class to divide the various aspects of the problem among small groups.

In addition to being efficient, small group work also provides for the opportunity to practice oral skills and for the exchange of ideas. After completing their investigations, the members of a group organize their findings and then present them to the class for discussion. Other language arts skills are learned as the children inform other classes about their findings or write letters to various social agencies to offer ways to describe people.

To clarify descriptive terms, the children naturally become involved with various aspects of measurement, such as units of measure, different measuring tools, and measurement reliability and accuracy. The need for a standard unit of measure arose in one second-grade class after each child had measured some of his classmates with his hand length. The class noted afterwards that the children's heights could not be compared because they were expressed in several different hand lengths. The children decided that to compare everyone's heights, they must measure everyone with the same unit of measure, i.e., use only one person's hand length to measure everyone. Measurement reliability was a concern for another primary class. A second height measurement was made after the class discovered that some children had taken their shoes off while others had not.

Graphing is easily introduced to primary children as they see the need to organize and make pictures of their information. Children in one third-grade class were able to deter-

mine the number of tall, medium, or short children in the class by comparing the heights of the column of blocks for each category. Each child in the class placed a colored block next to the height heading (tall, medium, short) that he thought his height was in comparison to other third graders.

Often times small children need to compare ratios or fractions. Comparison may be made and comprehended by the children without using division by construction of a graph called the slope diagram.* Each ratio may be plotted on the graph form. By drawing a line from the plotted point to the origin, the slopes of the different lines may be compared. Children in one third-grade class used the slope diagram to compare each child's head circumference with his head length. By comparing the slopes of the different lines, the class was able to determine whether a child had a fat or a thin face.

Many concepts of set theory are also easily grasped by primary children. One first/second-grade class used rope circles to find a description that separated each child from his classmates. Two large intersecting circles were made on the floor using rope. One circle represented girls, the other circle represented blue eyes. The children stood in the appropriate circle or in the intersecting area, if they possessed both characteristics. Later the class became involved with three intersecting circles representing three different characteristics.

Even though some children may want to construct their own measuring instruments, the Describing People unit does not involve much Design Lab work. However, experience in many schools has shown that primary children are able to work in the lab and are able to use the power tools with some adult assistance. Children working on USMES challenges have designed and built such items as tables, boxes, and even sandals from Tri-Wall or lumber.

4. FLOW CHART

The following flow chart presents some of the student activities--discussions, observations, calculations, constructions--that may occur during work on the Describing People challenge. Because each class will choose its own approach to the challenge, the sequence of events given here

*Formerly labeled triangle diagram.

represent only a few of the many possible variations. Furthermore, no one class is expected to undertake all the activities listed.

The flow chart is not a lesson plan and should not be used as one. Instead it illustrates how comprehensive investigations evolve from the students' discussion of a problem.

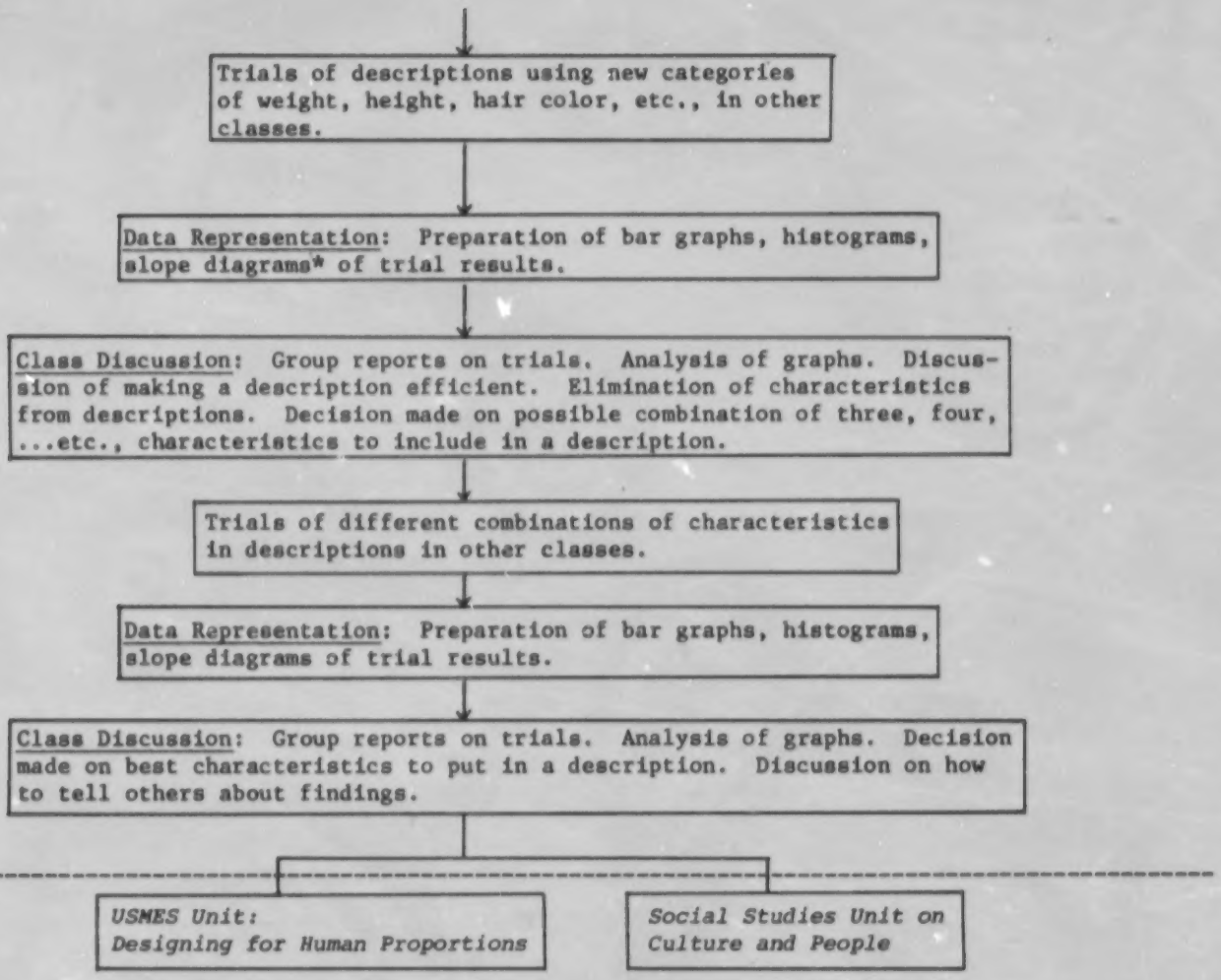
Challenge: *Determine the best information to put in a description so that a person can be quickly and easily identified.*

Optional Preliminary Activities:

- *USMES Unit: Designing for Human Proportions*
- *Social Studies Unit on Culture and People*

Possible Student Activities:

- Class Discussion: Why is it hard to find people sometimes? What happens when you cannot find your dad or mom in the store? How would you describe your parents (brother, sister, friend) so that they could be identified?
- Attempts made to identify children from teacher's descriptions.
- Descriptions of classmates written and tested by the class using the Sit-Down Game.
- Class Discussion: Difficulty of identifying some children using various descriptions. Discussion of permanent vs. changeable characteristics, e.g., clothing. List of people's similar and differing characteristics. Variability of characteristics, such as height, weight, hair and eye color. Discussion of how to identify certain characteristics.
- Construction of measuring tools. Checking tool accuracy and reliability. ↔ Data Collection: Collection of measurement data, such as height, weight.
- Data Collection: Collection of information on eye color, hair color, color of skin.
- Data Collection: Investigation of police, F.B.I. descriptions, missing persons descriptions, etc.
- Data Representation: Preparation of bar graphs, histograms, scatter diagrams.
- Class Discussion: Reports from groups. Analysis of graphs. Determination of categories (fat, medium, thin) for measurement data to be used in descriptions. Grouping of information on hair color, eye color, etc., into distinguishable categories.


Trials of descriptions using new categories of weight, height, hair color, etc., in other classes.
Data Representation: Preparation of bar graphs, histograms, slope diagrams* of trial results.
Class Discussion: Group reports on trials. Analysis of graphs. Discussion of making a description efficient. Elimination of characteristics from descriptions. Decision made on possible combination of three, four, ...etc., characteristics to include in a description.
Trials of different combinations of characteristics in descriptions in other classes.
Data Representation: Preparation of bar graphs, histograms, slope diagrams of trial results.
Class Discussion: Group reports on trials. Analysis of graphs. Decision made on best characteristics to put in a description. Discussion on how to tell others about findings.
Optional Follow-Up Activities:
USMES Unit: Designing for Human Proportions
Social Studies Unit on Culture and People

*Formerly labeled triangle diagram

5. A COMPOSITE LOG*

This hypothetical account of a fourth-grade class describes many of the activities and discussions mentioned in the flow chart. The composite log shows only one of the many progressions of events that might develop as a class investigates the Describing People challenge. Documented events from actual classes are italized and set apart from the text.

In checking the calendar one day the teacher notes that the first PTA meeting of the year is coming up. She mentions to the class that she is looking forward to meeting everyone's parents although she is not quite sure that she will be able to recognize many of them. Immediately John comments that his parents will be easy to pick out because both of his parents have black hair and are very short. Marianne says that her parents will also be easily recognizable because both have blond hair and her father wears brown-rimmed glasses. Other children begin to describe their parents, so the teacher suggests that everyone write a description of each parent. The children immediately become busy writing their descriptions.

After about five minutes everyone is finished. The children share their descriptions by reading them aloud. After three children have read their descriptions, one child comments that Mark's mother seems to look like Judy's mother. As the two descriptions are read again, the teacher records the characteristics on the board.

Mark's Mother		Judy's Mother	
brown eyes	thin	blue eyes	pretty
frosted hair	pretty	brown hair	has four girls
shag haircut	nice	wears her hair up	wears nice clothes
freckles	tall	tall	has nice jewelry
		thin	

The class notes which characteristics are the same for both mothers, and the teacher draws arrows between. Several children wonder about the terms "nice" and "wears nice clothes." Because several children are eager to read their descriptions, the teacher suggests that the class finish hearing the descriptions and then return to examine them later. The children agree and the rest of the descriptions are read.

Before the class examines the descriptions, the teacher summarizes some of the comments she heard while various parents were being described. She notes that Bill did not agree with Jack's description of his father, especially his height and color of hair. Two girls also questioned the

*Written by USMES Staff

From Judith B. White's First/Second Grade Class.

color Sally wrote for her mother's hair. The girls thought it to be more brown than blond. After several similar comments have been mentioned, the teacher writes the Describing People challenge on the board: Determine the best information to put in a description so that a person can be quickly and easily identified. The class discusses the challenge and then agrees that they are interested in finding the answer.

> *One third-grade class in Lansing, Michigan, was challenged to help their teacher recognize their parents at an upcoming PTA conference. The children drew pictures of their parents, but these showed very little differentiation. The class was then challenged to find an effective description of their parents. (From log by Viola Baas.)*

The children suggest characteristics that should be included in a description and the teacher records the long list on the board. Those characteristics that are contested by some children are starred and later debated. The final list consists of nine characteristics.

Characteristics that would be good to include in a description

clothes	hair color
height	eye color
age	skin color
sex	glasses/no glasses
weight	

The children decide to test the usefulness of their list of characteristics by writing another description. Each child pairs up with the child sitting behind him. The teacher tells the children to look carefully at their partner for one minute. Then they are to turn around and write a description. This procedure is followed and afterwards the teacher collects the papers.

The descriptions are tested by playing the Sit-Down Game. The teacher explains the game and the class proceeds to play. Everyone stands and the teacher picks one description to read aloud. As each characteristic in the description is read, those students who do not possess this characteristic sit down. Because time runs out, the class is unable to test all the descriptions that day.

The following day the class continues to play the Sit-Down Game. As each description is completed, it is placed either in the "successful" or "unsuccessful" pile. When all the descriptions have been read the class counts the number of successful descriptions and finds that it is fewer than half the class.

A discussion ensues over the differences between the successful and unsuccessful descriptions. Jamie notes that her description of Ned failed today because he is not wearing the red shirt he had on yesterday. Other children who had their descriptions read the previous day and had used the characteristic of clothing comment that their descriptions probably would not work today.

Jim suggests that clothing be dropped from the list since it can vary from day to day. Sue raises the point that people with glasses may not wear them all the time and that perhaps this characteristic should also be taken off the list. A quick vote reveals that everyone agrees to eliminate these two characteristics.

George expresses his unhappiness over the fact that Tom described him as "fat" and "short." A heated debate evolves over who is fat or thin. Before the debate gets out of hand, the teacher asks the class how they can define fat, medium, and thin or tall, medium, and short. One boy quickly states that the first thing they need to do is to weigh and measure everyone. Three boys volunteer to ask the school nurse if the class can borrow her scale.

> *After playing the Sit-Down Game several times, children in one third-grade class in Lexington, Massachusetts, noticed that some of their descriptions did not identify one particular person. The class closely examined the characteristics used in the descriptions and found discrepancies between their definitions, such as tall and medium for height. The children compared various heights but could not agree on who was tall or medium. They finally decided to resolve the issue by measuring everyone. (From log by Phyllis Viall Cooper.)*

The teacher then refocuses the class's attention on the other characteristics that the class has listed as being important to include in a description. She reminds the children that although the characteristic of clothing was successful on the day the descriptions were written, it was not helpful on the second.

Jennifer raises the question of how to define hair color. She claims that her hair is blond rather than light brown, but several girls disagree. Someone suggests cutting hair samples from everyone so that, by arranging the hair samples by color, they can see the various shades of black, brown, red, and blond. Jennifer volunteers to chair a hair color committee.

At this point the class has become eager to break into groups to work on the characteristics of height, weight, and color of hair. The teacher summarizes the class discussion, and everyone chooses the group he wants to be in.

Hair Color Group

Some members of the Hair Color Group want to begin immediately to clip samples. Other members want to organize some sort of plan, such as using the class list to check off each "donation" thereby avoiding the chance of obtaining two samples from one person. The names on the class list are divided equally among five of the group members. Two girls agree to organize the samples as they come in. Before disbanding, the children remind one another to label each sample.

At the next session the collected samples are spread on a large table. The obvious colors are grouped together first. There are sixteen various shades of brown, four black samples, three blond shades, and one red sample. It is a difficult task for the group to categorize the brown shades. Each shade is slightly different from the next sample. After spending considerable time in heated debate the group agrees to limit the categories of brown to two, light brown and dark brown.

Using these two categories, the group finds that there are five light brown and eleven dark brown samples. They then divide the hair samples into five color categories: blond, light brown, dark brown, black, and red. The teacher asks the group to think of a good way to explain their results to the class. Each child tries to make a chart or a graph. Later they agree that a bar graph is the best. Figure B5-1 shows their final graph.

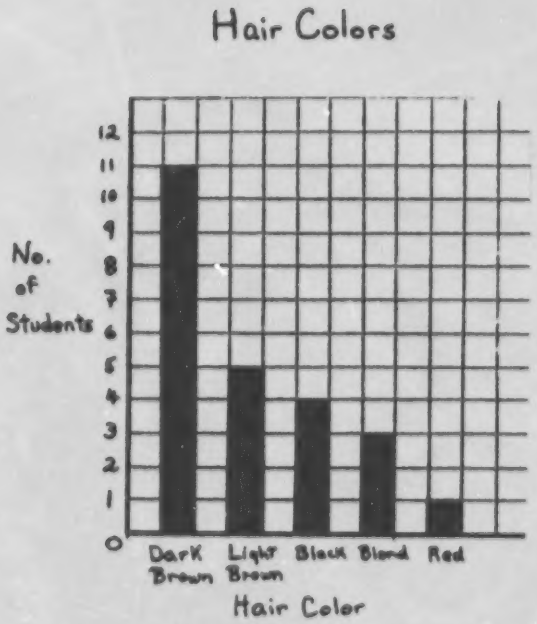


Figure B5-1

In one fifth-grade class in Monterey, California, the children who chose to clarify the characteristics of hair color collected hair samples to represent as many different color shades as possible. The samples were arranged on a chart. The group then made a bar graph showing the number of

students in the class with each shade of hair color. (From log by Barbara Dahlberg.)

Weight Group

The Weight Group obtains a bathroom scale from the nurse's office. The children then plan their procedure for weighing everyone in the class. They decide to have one person read the weight while another person records it. The rest of the group members agree to collect the children.

The first five children are weighed without incident. However, the sixth child contests the weight that is recorded for her and removes her bulky sweater and shoes for a second trial. This time her weight is two pounds less. The group now wonders whether the first five children should be recalled. Someone questions whether the clothing variability between children is enough to worry about.

Because an agreement cannot be reached, the group decides to recall two of the children. The two children are asked to remove their shoes and sweaters before being weighed again. Their second weights are then compared to their first. Because the difference is found to be one pound in each case, the group decides to have all the children remove both outside bulky sweaters and shoes. The weighing then continues until everyone in the class has been weighed.

The weight data is arranged in ascending order and then tallied. The data appears as follows.

pounds	pounds	pounds
61 //	70 ///	78 /
63 /	72 /	79 /
67 //	73 /	83 /
68 /	74 /	84 /
69 ////	75 /	92 /
	76 /	100 /

The children note that the range of weights is from 61 pounds to 100 pounds, or 39 pounds. They also note that most children weigh between 67 and 70 pounds. The children decide that those who weigh 66 pounds or less are thin, 67 to 70 pounds are medium and over 71 pounds are heavy.

After discussing how to make a graph of the data, the children look at the "How To" Cards. They decide to make X's in columns, with each showing a spread of two pounds.

The bar graph histogram is shown in Figure B5-2. Several members of the group now point out that using their classification, ten children, or almost half the class, would be considered overweight. The group agrees that the heavy category is too large and expands the medium category to include those weighing up to seventy-eight pounds. Their final three categories appear as follows:

thin: 66 pounds or less

medium: 67-78 pounds

heavy: 79 pounds or more

Someone suggests adding an "extra heavy" category for Joey, but everyone else immediately objects.

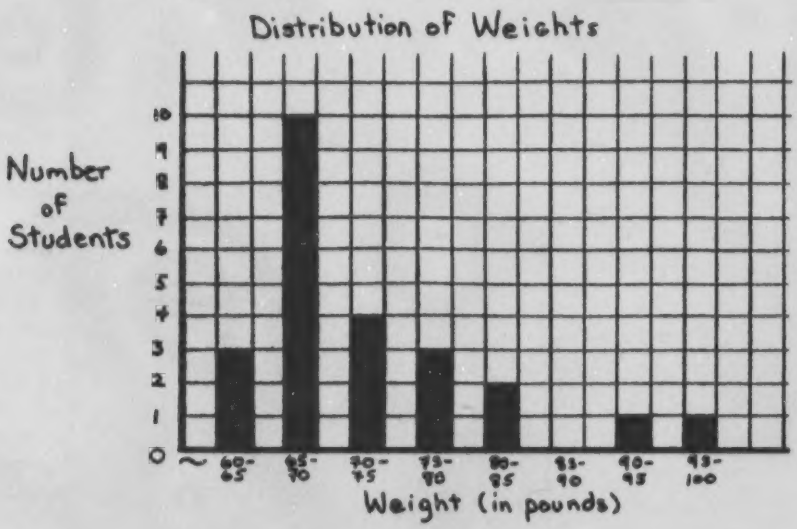


Figure B5-2

A third-grade class in Eaton Rapids, Michigan, agreed upon three categories (heavy, medium, and light) to describe weight. Each child then placed a block under the category that he thought best described his weight. Later, each child weighed himself and recorded his weight on the board under the same category that his block was placed. The children noticed that within each category the range of weights was different. The children felt that this was unfair so the total

Name	Height (cm)	Name	Height (cm)

Figure B5-3

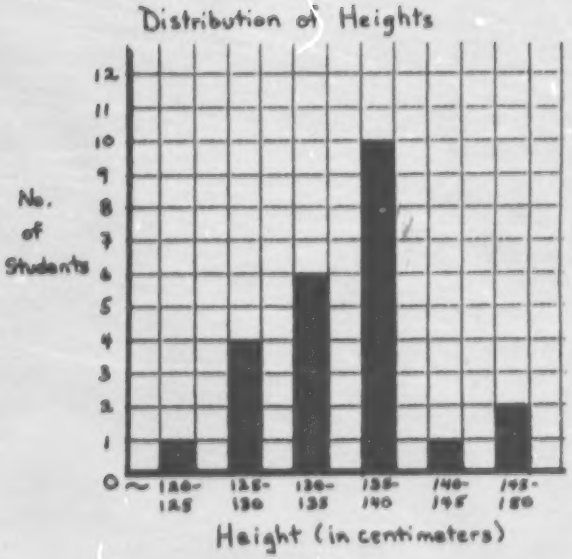


Figure B5-4

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range for the class was determined and divided by three to determine the range of weights under each category. (See log by Charlotte Hayes.)

Height Group

The Height Group sets up some preliminary procedures. They pick a free wall in the room to use and push some of classroom furniture out of the way. Meter sticks are obtained, and taped to the wall. In order to keep a record of the measurements, two boys made a simple chart. (Figure B5-3 shows the chart form.) One boy volunteers to act as a recorder, and two girls volunteer to measure. Another boy assigns himself the task of checking the measurer's accuracy, and the rest of the group members agree to scout out people to be measured.

The first heights that are measured and recorded are those of the Height Group members. The one being measured stands erect with his back against the wall. A ruler is placed on top of his head, and the measurement is read where the bottom of the ruler touches the meter stick. The measurement is then rounded off to the nearest centimeter and recorded on the chart. If the measurement looks exactly halfway between centimeter marks it is rounded down to the centimeter below the measurement point.

After three members have been measured, the accuracy checker suddenly notes that Mary's shoes have thick heels. The children look at Mary's shoes and compare them with theirs. Some children have sneakers on, others have low hard-soled shoes on. The children agree then that everyone should be measured in his stocking feet. The group members that were measured already are then remeasured.

The scouts disperse to gather people and collect several who have just been weighed. They make an agreement with the Weight Group to have the children who have been weighed to proceed to the height-measuring station. After one hour all the children in the class are measured.

The Height Group ranks the height data from high to low and puts the data on a histogram which is shown in Figure B5-4. Based on the clustering of the data, the group decides upon the following three categories:

short:	130 cm and below
medium:	131 cm to 141 cm
tall:	142 cm and above

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When it is evident that the three groups have completed their tasks, the class meets as a whole to share information. Each group relates what it has done and shows its graph or chart. Discussion usually centers around whether the rest of the class agrees with the group's classification.

One boy complains that he is not "heavy" even though he weighs the same as John. The two boys stand side by side for a comparison. Peter is taller than John, and most of the class agrees with his opinion that he does not look heavy.

The class then realizes that weight alone does not determine whether a person is thin or heavy. The children decide to reclassify everyone by visually deciding whether he or she appears thin, medium, or heavy. After considerable time and debate the class arrives at the following numbers of children who look thin, medium, and heavy:

thin: 2

medium: 18

heavy: 4

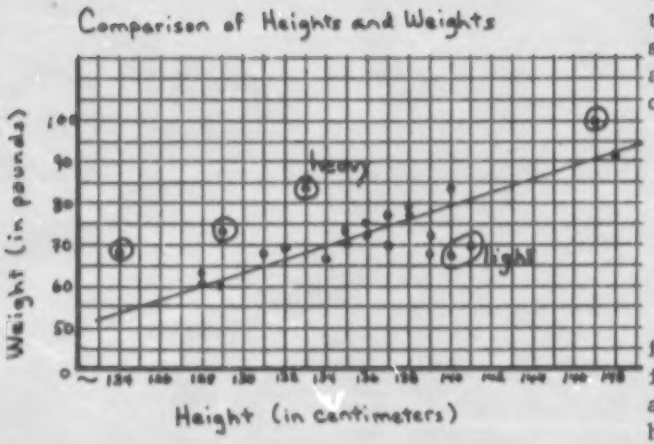

Figure B5-5

The teacher then shows the class how their visual classifications can be verified. A skill session on scatter graphs is given by the teacher. A graph grid is drawn on the board, and a point is put on the graph for each person according to his or her height and weight. Figure B5-5 shows the scatter graph of the children's heights and weights. The children examine the graph and note that as height increases, weight increases. They also note that with few exceptions, the points seem to cluster around the line that is drawn to indicate the trend of points. The four points far above the line represent the children they feel are heavy, and the two points way below the line represent those who are thin. The children are pleased that the scatter graph closely matches their visual classification and agree to use it when testing descriptions.

The class again discusses their challenge. It is generally agreed that the descriptions should now be more effective. Someone questions whether they should change the category title of "weight" to "build" since they considered both a person's height and weight in classifying him, and the class agrees. The characteristics that the class had previously listed as being effective in a description are listed again on the board and appear as follows:

height	sex	eye color
build	hair color	
age	skin color	

The teacher then asks the class which of the above characteristics are the best four.

Several boys feel the characteristic of eye color should be eliminated. Another group feels that a description without the characteristic of hair color can be still successful. The teacher lists the popular combinations on the board.

height	height	build	height
build	build	sex	build
sex	sex	eye color	eye color
hair color	eye color	hair color	hair color

In order to test the various combinations the class decides to divide into four groups of six members, each group using one combination of characteristics to describe each member in the group. Someone comments that he is now familiar with many of the characteristics used to describe various classmates and suggests describing students in other classes. The class eagerly asks the teacher if this is possible. The teacher consents and sends two students to Mr. J.'s class to see whether students can come into his room occasionally. Mr. J. consents provided the children do not disrupt his class.

The class revises the plan for writing and testing descriptions. They decide that two children from a group should write a description of one child in Mr. J.'s class using one of the combinations of characteristics. Another pair will then try to identify that child. A chart is made to tally the total number of trials and the total number of successful trials for each combination of characteristics.

> *The third-grade class in Lexington, Massachusetts, tested some of their descriptions in other classes. Working in small groups of two or three members, each group picked a child in another class to describe. The description was then given to a second small group who then tried to identify the child in that class. (From log by Phyllis Viall Cooper.)*

After the third day of testing the different combinations of characteristics, the class's chart appears as follows:

Characteristics	Total Trials	No. Successful Trials
height, build, sex, hair color	3	2
height, build, sex, eye color	5	3
build, sex, eye color, hair color	4	2
height, build, eye color hair color	5	2

The class compares the number of successful trials for each group and quickly agrees that the group using height, build, sex, eye color was most successful.

Suddenly, one girl points out that there are unequal number of trials for each group of characteristics. The children realize that they must compare the number of successful trials with the total number of trials for each group or the following fractions:

Group	Ratio: No. Successful Trials / Total No. Trials
build, sex, eye color, hair color	2/4
height, build, sex, hair color	2/3
height, build, eye color, hair color	2/5
height, build, sex, eye color	3/5

Children in a first/second-grade class in Lexington, Massachusetts, divided into groups to test four combinations of three characteristics. Each group used one combination of characteristics to describe all its members. The group then played the Sit-Down Game and recorded the number of times a child was successfully identified. In order to determine the most effective combination of characteristics, the class compared the number of successful trials with the number of children in a group. (See log by Judith White.)

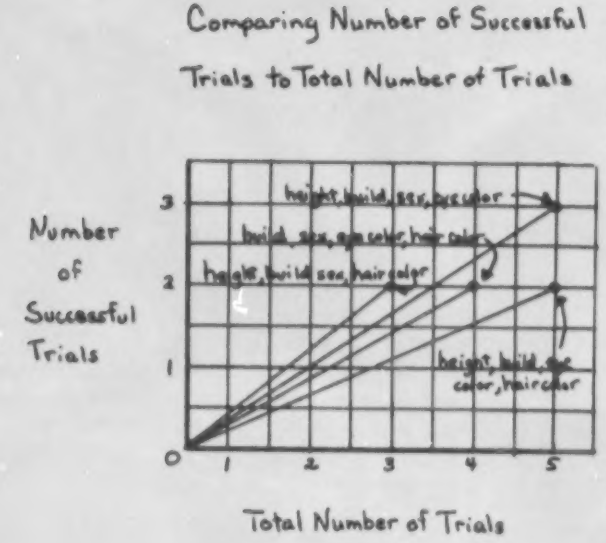

Figure B5-6

After it becomes evident that the children are unsure of how to compare the fractions, the teacher gives a skill session on slope diagrams.* Together the class and teacher draw the graph on the board. Figure B5-6 shows their final graph. Looking at the representations of each fraction, the children see that the steeper the line that connects the point to the point of origin (slope of the line), the larger the fraction. The children then list the groups of characteristics in order of effectiveness with the most effective combination listed first:

height, build, sex, hair color
height, build, sex, eye color
build, sex, eye color, hair color
height, build, eye color, hair color

After repeating the trials in another class with the same result, the class feels satisfied that the challenge has been met. One girl reminds everyone that they should tell Mr. J.'s class their results. Someone suggests telling the other grades also. One group of boys wants to tell the police department since the police are always looking for lost children. A third group of children wants to look further into differences of people, such as body proportions. After briefly discussing the alternatives, the children decide to first conclude the Describing People activities before moving into another challenge. The class subsequently divides into two groups, one group to write a letter to the police department and the other to prepare presentations for Mr. J.'s class as well as the other grades.

6. QUESTIONS TO STIMULATE FURTHER INVESTIGATION AND ANALYSIS

- Why is it hard to find people sometimes? What happens when you become separated from your father (mother) in a crowded store?
- How would you describe your father, sister, or friend so that they could be quickly and easily identified?
- Which characteristics would be more helpful than others in identification? Why?

*Formerly known as triangle diagram.

- Which characteristics may change from time to time? Which characteristics may change with age? How much can certain characteristics be changed?

- When are descriptions of clothes useful? When are they of little use?

- What is meant by "short," "medium," or "tall"? How can we find out which children in our class are short, medium, or tall?

- How many different hair colors are there in our class? How many different eye colors are there in our class? How can we make sure our terms are reliable?

- How can we determine if two characteristics, such as height and weight, are related? If two characteristics are closely related, do both need to be included in a description? Why?

- Is weight or size a more useful characteristic for identification purposes? Why?

- What is the smallest number of characteristics that can be used in identifying one person? How many students in our class can be described and identified using only two characteristics? Three characteristics? Four characteristics?

- How can we find out which are the best three (four, five, etc.) characteristics to use in a description?

- How often will these three (four, five, etc.) characteristics be successful in our class? Will they be successful as often in another class? How many classes do we need to test to know how well these characteristics will work in most groups?

- How does our list of characteristics compare with the characteristics used by the Federal Bureau of Investigation, Police Department, or the Missing Persons Bureau? How can we find out?

- How can we organize our data so that others may see how we arrived at our conclusions?

C. Documentation

1. LOG ON DESCRIBING PEOPLE

by Judith B. White*
Adams School, Grades 1-2
Lexington, Massachusetts
(March 1973-June 1973)

ABSTRACT

This first/second-grade class was asked what they could do if one of their classmates, such as Johanna, became lost on a class field trip. The class responded that they would call the police to report that a girl named Johanna with a pigtail was lost. The teacher then challenged them to find ways to describe people. The children compiled a list of characteristics they thought would be effective in identifying a person. Descriptions were written and tested. To help describe themselves more accurately, the children collected and graphed data on themselves. Distinction was made between permanent and changeable characteristics. Working in small groups, the class investigated which three characteristics were most effective in correctly identifying a person. Several combinations of three characteristics were tested by playing variations of the Sit-Down Game and identifying children in another class. The children also compiled two flow charts showing characteristics that would be best for describing people.

I began the Describing People unit in the month of March with the following question: "If we were on a field trip and Johanna (a first grader) were lost, what could we do?" The children suggested calling the police to report that a little girl named Johanna with a pigtail was lost. We then talked about other characteristics that could be used to describe Johanna. The following list of characteristics was compiled on the board:

color of hair
clothes
where she was last seen
name

*Edited by USMES staff

Billy #3

curly hair
skinny
glasses

color of eyes
black or white (color of skin)
how tall she was (height)
length of hair
braid
age
color of shoes or boots
barrettes
glasses or no glasses

The children felt that if the above characteristics were given to the proper authorities, we would not have any difficulty finding our Johanna.

We then chose to describe Andy and to test our description by asking our student teacher to use the description to identify the correct child. The children could not agree on the color of his hair, and so we decided to include all the suggested colors. Beside each hair color we put the number of children who voted for this color. The following was the children's description of Andy:

no glasses
short hair
yellow shirt
blue pants
six years old
three and one-half feet tall
white
weighs fifty pounds
he's a boy
nineteen-inch right arm
real light brown hair (2)
regular blond hair (1)
yellow hair (1)
yellowish-brownish hair (6)
bright blond hair (1)
light like Joey's but not as much brown (8)

I asked the children if the third and fourth characteristics in the above list were good ones to use. What if he decided to change his clothes? After a discussion they decided that Andy would not wear these clothes everyday; these characteristics were then eliminated from the description.

With this information the student teacher correctly identified Andy, and the children were delighted. This seemed

to be an excellent beginning to the unit as the children really enjoyed describing their two classmates.

The following week each student wrote a description of their classmate Beth. We examined all the descriptions afterwards. The children noticed that the characteristics of blue eyes and red hair were included in most of the descriptions. (The rest of the characteristics varied widely in the descriptions.*) We agreed then that these two characteristics were Beth's distinctive features.

In our next session we decided to describe all the members in our class by their hand spans. Graphing was also introduced as a means of displaying data. Below is the children's description of this session's activities and their explanation of the resulting graph, one of which is shown in Figure C1-1.

HAND SPANS GRAPH

We put our hands on a piece of paper and traced them. We used a ruler to measure our hand spans. We made ourselves in lines 6", 6 1/2", 7", 7 1/2", 8". Then we made our graphs.

The graph tells how many children were in each line. Six children had 6" hand spans. There were two teachers who had 8" hand spans. There were 3 5" hand spans. That would be 15. Then 2 more make 17 and 6 more equals 23. There were 20 children and 3 teachers in our class today.

*The children could construct a bar graph tally of the different characteristics used. They could then use this information later when searching for the best three or four characteristics to include in a description.--ED.

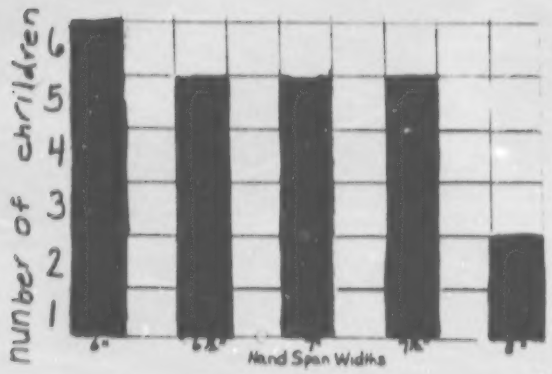

Figure C1-1

Aaron (submitted by Beth)
boy
brownish-blackish hair
brown eyes

Tracy (submitted by Rolf)
girl
brownish-blackish hair
first grader
no glasses
blue eyes

Maria (submitted by Johanna)
blue eyes
medium length hair
no teeth out
girl
first grader

Figure C1-2

Before we played the Sit-Down Game one day, each child picked a classmate to describe. The children used as few as three and as many as six characteristics to describe their subject.* While playing the game, the children noticed that the characteristic of sex eliminated more choices than any other characteristic. All the descriptions successfully singled out the correct child. Figure C1-2 shows some of the children's descriptions.

After playing the Sit-Down Game we investigated what would be the three best characteristics to include in a description. I posed the problem to the class: "If Mr. Jacobus (the school principal) came to our room and wanted a description of everyone in the class using only three characteristics, what would be the best ones to use?" The children quickly named many characteristics, such as boy or girl, glasses or no glasses, color of eyes, color of skin, color of hair, height, dress or pants.

A discussion of permanent and changeable characteristics ensued. The children agreed that such characteristics as clothes, hair style, hair length, and glasses or no glasses, could vary from day to day. These were then removed from the list. One child questioned the usefulness of the characteristic of parents' identity. After some thought the class agreed that parents and their offspring do not necessarily look alike. This characteristic was also taken off the list. At the end of our discussion five characteristics remained on the list: sex, color of eyes, color of hair, height, and color of skin.

We took a vote to choose the best three characteristics, but the votes were fairly evenly divided among the five characteristics. We therefore listed the popular combinations on the board, and the children grouped themselves around the combination they thought was best. These were four combinations:

sex	sex	sex	sex
eye color	hair color	eye color	eye color
hair color	height	skin color	height

*As the Sit-Down Game progresses, check marks could be placed on a histogram to show the number of characteristics that are needed to identify a person.--ED.

In each group the members wrote descriptions of themselves using the three characteristics they had decided were the most effective for identifying a person. For example, all the members of the group choosing sex/eye color/hair color used these three characteristics to describe themselves.

The following week the class used the Sit-Down Game to test which group's three characteristics were most successful in identification. We kept track of the game results and later recorded the data on a chart. The results were as follows:

Group	No. Members in Group	No. Successful Identifications	No. Unsuccessful Identifications
Sex/eye color/hair color	2	1	1
Sex/hair color/height	4	2	2
Sex/eye color/skin color	3	2	1
Sex/eye color/height	10	6	4

We analyzed the results. At first the class felt that the characteristic combination sex/eye color/height was the most successful because the group had six correct identifications. Someone, however, pointed out that they also had the most group members. The children then compared the number of successful identifications to the number of members in the group. They observed that the combination of characteristics sex/eye color/hair color was just as successful as the combination sex/hair color/height. Each group had been fifty per cent or one-half correct. The class also noted that the characteristic combination sex/eye color/skin color was two-thirds successful and that the combination of sex/eye color/height was six-tenths successful.

This session was just priceless. From our Describing People activities we found ourselves involved in the comparison of fractions.*

We further tested our descriptions using only three characteristics by playing a game that we made up. We called

*A good way to compare ratios or fractions is to use a slope diagram (formerly called triangle diagram).--ED.

it the Jungle Game. The class divided into two teams, one team being animals, the other being hunters. A scout was chosen from the Hunter Group to look in the jungle for an animal. When he found an animal, he brought a description (limited to three characteristics) back to his group of hunters. The hunters decided among themselves who this animal was. A correct identification was a point for the Hunter Group. We played the game several times and reversed roles.

All the descriptions were successful except one (short hair, brown eyes, sneakers). The class felt that the characteristics of sex or grade level would have been more useful than the characteristic of sneakers because several children had on sneakers that day.

The next week we played another version of the Sit-Down Game. The children were paired off. They sat facing their partner for three minutes observing them without talking. When time was up, they sat back to back and wrote a description of their partner. We had time to test only seven descriptions. All seven were successful; each person was correctly identified using usually fewer than five characteristics.

Because the children were so "experienced" in describing people, I asked them one day, "What type of guide could we provide for someone who came to our room this minute and asked, 'How can I describe the boy who is missing in Ms. Wilson's class?'"

The children agreed to divide into four groups to generate a list of characteristics. So that each group would not influence the others' lists, the groups were placed in each corner of the classroom. Each group consciously generated a list with the most characteristics possible. The four lists that were produced are shown below.

GROUP 1

1. boy or girl
2. glasses or no glasses
3. color of eyes
4. color of hair
5. color of skin
6. height
7. grade
8. age
9. length of hair
10. scratches or no scratches
11. weight
12. sneakers or no sneakers
13. slacks or no slacks
14. dress or no dress
15. short or long-sleeved shirt
16. texture of hair
17. teeth out
18. length of leg
19. length of arm
20. belt or no belt

GROUP 2

1. boy or girl
2. glasses or no glasses
3. color of eyes
4. color of hair
5. color of skin
6. height
7. grade
8. age
9. length of hair
10. sneakers or no sneakers
11. slacks or no slacks
12. dress or no dress
13. teeth out
14. ponytail or no ponytail
15. barrette or no barrette
16. new or old shoes
17. broken arm or not
18. sister or brother

GROUP 3

1. boy or girl
2. glasses or no glasses
3. color of eyes
4. color of hair
5. color of skin
6. height
7. grade
8. age
9. length of hair
10. scratches or no scratches
11. weight
12. sneakers or no sneakers
13. clothes

GROUP 4

1. boy or girl
2. glasses or no glasses
3. color of eyes
4. color of hair
5. color of skin
6. height
7. grade
8. age
9. length of hair
10. scratches or no scratches
11. weight
12. slacks or no slacks
13. dress or no dress
14. short- or long-sleeved shirt
15. ponytail or no ponytail
16. pretty or not pretty
17. color of clothes

The children in each group were convinced that if anyone came to our room seeking help in identifying a person, they could not go wrong if they used their chart.

Later, the children decided that a flow chart would also be a helpful guide for anyone who wanted assistance in describing a person. The class made two using the characteristics listed in the last session. The first chart included characteristics common to all the group listings. The second chart included characteristics that, though not common

to all the groups' lists, were considered important by the children. The children's charts appear below.

CHART #1

START → boy or girl → glasses or no glasses → color of eyes →

hair color → color of skin → height → grade → age →

length of hair → STOP

CHART #2

START → weight → texture of hair → teeth out →

length of leg → length of arm → scratches or no scratches → belt or no belt →

sneakers or no sneakers → freckles or no freckles → short- or long-sleeved shirt →

slacks or no slacks → new or old shoes → sister or brother → dress or no dress →

broken arm or not → barrette or not → ponytail or not →

clothes → pretty or not pretty → color of clothes → STOP

To help describe themselves better, the children collected some data on themselves. A survey form that was made up by me was passed out to the children. The survey included obtaining the following characteristic information: sex, height, weight, freckles or no freckles, glasses or no glasses.

The data collection was very successful and lasted for quite some time since this was the first time many of the children had been involved with measuring sticks and scales.

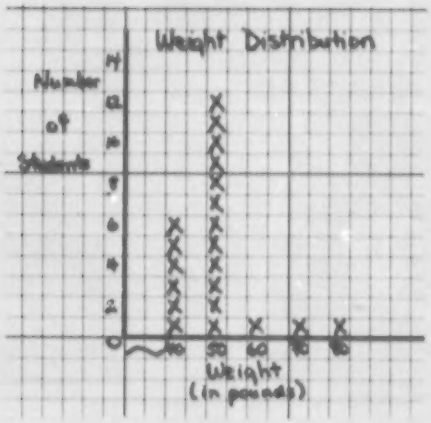

Figure C1-3

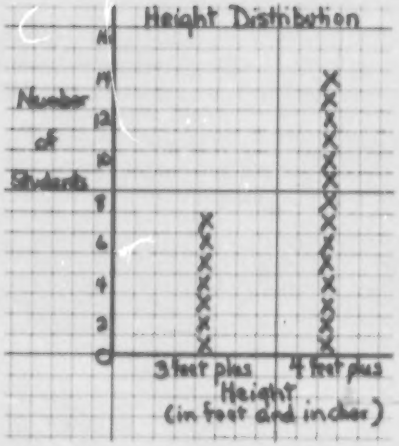

Figure C1-4

The children first estimated both their height and weight. Later they had the opportunity to weigh each other on the nurse's scale. When the children measured one another's height, we became involved in converting inches into feet and inches for a more accurate description of height. After all the data had been compiled, we discussed ways of making it readily available to all in the class. After a discussion the children agreed that charting this data would be best.

It was decided that bar graph tallies of the different characteristics would be made. For each characteristic on their survey form the class decided the number of columns needed and how these columns would be labeled to represent the data. It was decided that sex required two columns to represent boys and girls. For the next characteristic of weight I asked the class how many columns would be needed. Because the range was between thirty pounds and eighty pounds, the children decided to label the columns with ten-pound intervals: 30, 40, 50, etc. For height the class decided that two columns were needed. These two columns were labeled "three feet plus" and "four feet plus." The last two characteristics required two columns each, glasses or no glasses and freckles or no freckles.

As the class proceeded to complete the weight bar graph on the front board, disagreements occurred. One boy who was rather tall and heavy started to place his "X" in the eighty-pound column. Several children objected. He was asked to stand in front of the class so that everyone could get a good look at him. The children decided that he did "look" eighty pounds after several children stood beside him for comparison. Upon completing the chart, the children discovered that there was no one who weighed thirty pounds. This column was therefore eliminated. The resulting weight graph showed that the majority of the students weighed fifty pounds. (See Figure C1-3.)

The class then completed the height graph in the same manner as the weight graph. Beth had been absent the day the class had collected the data. I asked the class if there were some quick way to determine her height. Martha suggested that she and Beth stand back to back. Because Beth was slightly taller, the class decided that she was four feet. One child felt the back to back comparison was not accurate enough and quickly obtained a yardstick and measured Beth's height, which was then recorded on the graph. (See Figure C1-4.)

The last two graphs, glasses and freckles, (see Figures C1-5 and C1-6) were quickly completed with no problems.

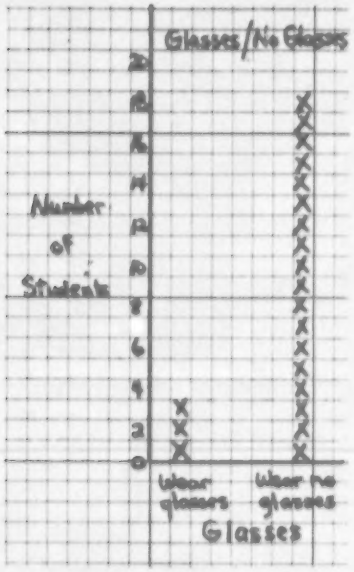

Figure C1-5

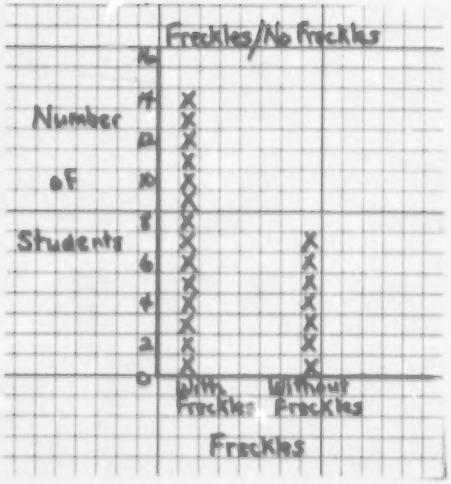

Figure C1-6

Upon completion of the graphs on the board the class brcke into small groups and recorded these graphs on paper.

We involved another class in one of our Describing People sessions. Nine children were picked to go down to Ms. Wilson's class. Each child picked one of Ms. Wilson's children to describe. The descriptions included only three characteristics. After writing the descriptions, the children returned to our classroom. Nine new children were picked to go to Ms. Wilson's class to identify the described children using their classmates' descriptions. The children were successful with eight descriptions. The ninth description failed because the finder had mixed the characteristics up.

The following descriptions were successful:

Linda	Alan	Aaron	Tracy
girl	brown eyes	glasses	blond hair
green eyes	brown skin	white shirt	freckles
dress on	boy	boy	blue eyes

Johanna	Rolf	Sarah	Martha
short hair	brown eyes	girl	blond hair
girl	boy	pink barrette	blue eyes
red bow around her dress	brownish-yellowish hair	short white hair	girl

Christine was not correctly identified (purple shirt, blue eyes, blue pants) because Stephen brought back a child who was wearing purple pants and an orange shirt.

Following this activity, we discussed what would be the best description that could be used both today and seven days from now. The children decided that descriptions with physical characteristics, rather than clothing, were best.

In one session, we discussed what would happen if a typical department store situation were reversed: "We are shopping in a store and, lo and behold, our mother gets lost! We must find her so we go to the Lost and Found Mothers Department." The children took out pictures they had previously drawn of their mothers. We placed them in front so all could see. I told the class that I would read one of their descriptions of their mothers. They were to see whether they could pick out the correct mother.

Several descriptions were read and the correct mother was picked in each case. Following each identification, I asked the class what was the characteristic that had given them the

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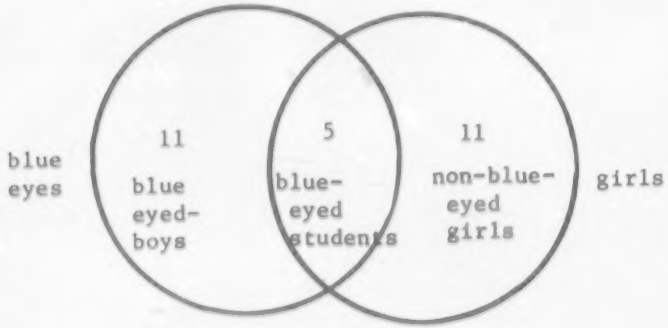
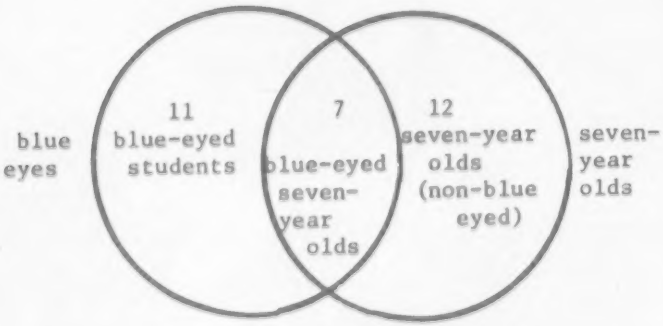
clue. These clues were recorded on the board and included glasses, freckles, hair texture, color of shoes, and clothing.

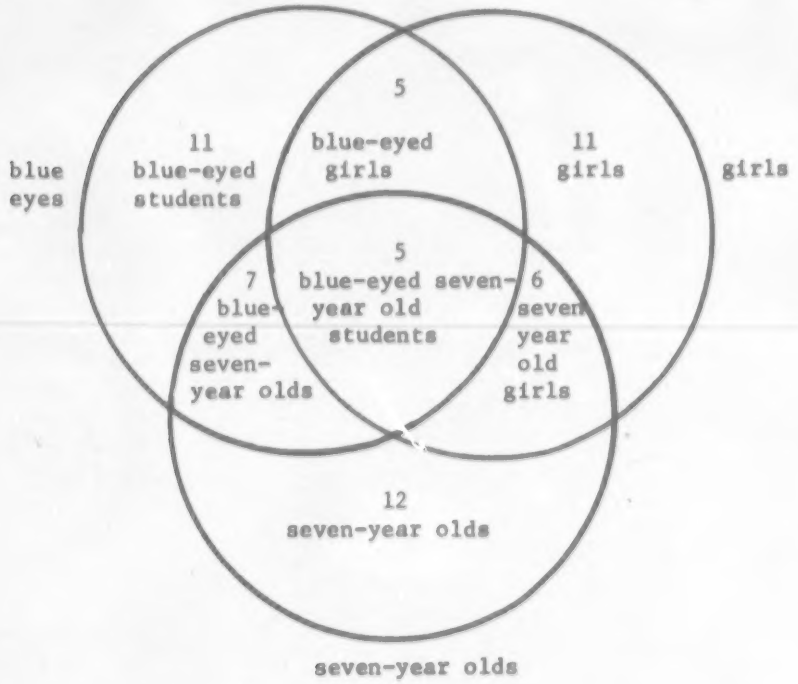
With one description, black hair, long hair, is German, the class was able to guess who the mother was but was unable to match a picture until after some time. I asked them why they had picked the picture that they had. One response was that "the lady in the picture looks German." With this, we talked about national origin and whether we could describe people using this characteristic. We looked at two pictures on the board, one person was wearing a French beret, the other was a Dutchman smoking a long stemmed pipe. The class, reflecting on a film they had seen quite some time ago on German women, decided that German women have stronger faces and broader shoulders than other Europeans.

In one of our last few USMES sessions we further enriched our study of set theory by implementing the use of rope circles. We started off using only two characteristics. The following were a few of our rope circles:





Later, as the children became more familiar with the rope circles we became involved with three intersecting circles using the same characteristics as above.



As a culminating activity the children selected pictures of people from magazines to describe. They greatly enjoyed this final activity.

2. LOG ON DESCRIBING PEOPLE

by Charlotte Hayes*
Northwestern School, Grade 3
Eaton Rapids, Michigan
(November 1971-May 1972)

ABSTRACT

This third-grade class became interested in the Describing People challenge after several unsuccessful attempts to locate a black-haired, brown-eyed boy in the school library. The class compiled a list of characteristics that they felt would be helpful in identifying someone and used them to try to identify their classmates. It was not long before the students noticed discrepancies in the use of such terms as heavy, medium, and light for weight. To clarify these descriptive terms, the class gathered body measurements, such as height and weight. Based on the analyses of their graphs, categories such as tall, medium, and short for height, and heavy, medium, and light for weight were established. The class also examined facial characteristics. The accuracy of their descriptions was tested by playing the Sit-Down Game and by trying to identify a child in another class. Just before spring vacation an incident occurred in the school which involved one of the older students. An accurate description of the student by the reporting child helped the principal to identify the student.

During class one day I asked one of my students to go to the library and to bring back one of Miss Wolfe's students. (Prior to this I had arranged with Miss Wolfe a convenient time when my students could come to her class.) I told Shelly that I could not remember the boy's name but did remember that he had black hair and brown eyes. A short time later Shelly returned with a brown-haired, blue-eyed boy. I reminded her that the boy I wanted had black hair and brown eyes.

Another attempt was made to find the described boy by another student. After a period of time in the library she returned quite disturbed because she, too, could not find the described boy. By this time everyone was really curious to know who this boy was.

We talked about why it was such a difficult task to find a black-haired, brown-eyed boy. One student suggested that there was no student in the school with such a combination of characteristics. This remark prompted me to summon two boys to the front of the classroom. Both boys had black

*Edited by USMES staff

hair and brown eyes. I asked my class which boy I wanted. The students were silent for a moment. Suddenly one girl exclaimed, "Mrs. Hayes, you didn't give us a good enough description of the boy!"

I then proceeded to relate to the class the dilemma that I had faced when I had taken a trip to Mexico. Because the tour guide and I had not exchanged photographs, I was very concerned about how he would identify me at the airport. As it was, we did manage to find one another, but only after a long period of time. I then asked the class how I could have described myself so that he could have easily identified m had we exchanged letters before the trip. The students offered many characteristics that included the following:

hair style	skin color--white, brown, yellow, or red
curly or straight hair	eye color
bald or not bald	type of voice (tone of voice)
hair color	long or short nose
hair length	fat or skinny lips
old or young	false teeth or not
short or tall	buckteeth or not
fat or skinny	fat or skinny cheeks
freckles or no freckles	color of shoes
glasses or no glasses	kind of rings you wore
kind of eyelashes	color of fingernail polish
pierced ears or not	kind of watch
color of earrings	color of lipstick
color of socks	color of coat
color of hat	color of suitcase
color of your suit	using crutches or not
jewelry or no jewelry	
kind of ears you had	

The students also offered three other ways the guide or I could have found one another.

Page the person.
If someone is with you, describe the other person too.
If you have a dog, tell the guide. No one will miss you if your dog is cute.

We concluded this first session by playing the Sit-Down Game. All the students were asked to stand. As I stated a characteristic, those students who did not have it sat down. At the end of the game a tall, black-haired, dimpled boy with blue in his shirt was left standing.

To Mrs. Hayes, I have blue eyes short nose brown hair It is short long lege skinny checks a tong ten fingers ten toes lots of freckle I ware close I use my eyes to see I am a good writer I have two eyes one nose one mouth

From Guess who

Name_____

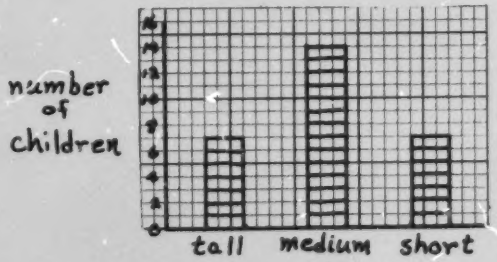
I have long blond hair. I am kind of tall and I am white skined I have ten toes and fingrs. I have two arms and leggs. I have blue eyes. I have bangs. I have two brothers and one sister and a father and mother I am mising two teeth.

Figure C2-1

After the class was dismissed, I returned to my desk to find the two descriptions shown in Figure C2-1.

For the next several weeks we practiced writing descriptions of ourselves and tested them by playing the Sit-Down Game. During several games the children noticed that it was difficult to eliminate someone when only two or three students were left standing. In talking about this situation the class realized that there were discrepancies in the use of many descriptive terms, such as fat, medium, and thin for weight, and black, brown, and blue for eye color. We agreed that we needed to standardize our use of these descriptive terms. During the ensuing months we collected data on ourselves.

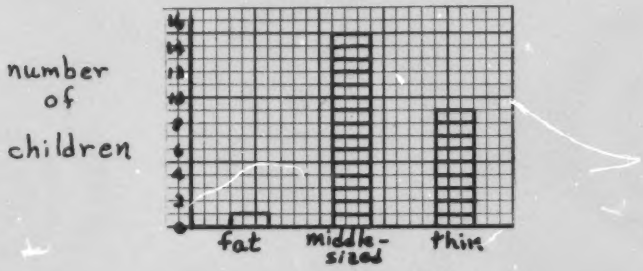
The first characteristic the class wanted to investigate was height. We decided that we would first guess our heights. The class designated height as tall, average, and short and wrote these headings on the board. Each child then took turns placing a block on the chalkboard tray beneath the heading he thought described his height in comparison to other third graders. After every child had placed his block, we had three columns of blocks under each heading. According to the block graph there were seven tall, fourteen medium, and seven short children in the class.



During the above activity four students were challenged as to where they had placed their block. We decided to compare their heights. The first two students had described themselves as "tall" and "medium"; the members of the second pair had described themselves as "medium" and "short." When the "tall" and "medium" students were compared back to back, the "medium" student was taller than the "tall" student. This reverse situation was also found true in the second pair. All four decided to change their blocks. The class noted afterwards that the column heights remained unchanged.

Before the block columns were taken down, we talked about the similarity between the stacks of blocks and the bar graph. The children then made their own bar graphs.

The next session we worked on the characteristic of size. The children decided that the categories, fat, middle-sized, thin, were appropriate. Once again each child placed a block under the heading which he thought best described himself. Comparisons between individuals were made when discrepancies occurred. Bar graphs were again made of the results. There were one fat, fifteen middle-sized, and nine thin children in our class.



The class was very interested in this session. As students were placing their blocks, several children noted that a person could be misclassified because of the clothes he had on, such as a bulky sweater that made him appear fat rather than medium-sized.

For the characteristic of weight the class decided upon the categories of heavy, medium, and light. Before placing their blocks under these headings, we talked about the possibility of someone's being heavy but not appearing fat.* After the blocks were placed, the children observed that there were four heavy, fourteen medium, and seven light children in the class. (See sketch at top of next page.)

One boy commented that he thought the "heavy" and "light" columns were too high. Using a scale in the room, each child weighed himself and recorded his weight under the same category that he had placed his block.

Looking at the actual weights, the class noted that there were some "medium" children who should have been classified as "light." We decided that we needed to do some redistributing of the weights.

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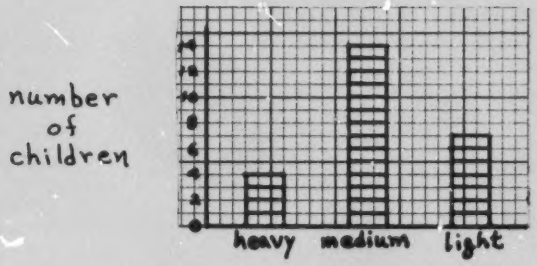
*The class could discuss whether weight or size is a more useful characteristic for identification purposes. One way of determining size is to use the slope diagram (formerly called triangle diagram) to compare height and weight measurements.--ED.



The range of all the weights was forty-six pounds to ninety pounds. The class arbitrarily decided that the "light" category should include forty-six through fifty-five pounds, "medium" should include fifty-six through seventy pounds, and "heavy" should include seventy-one through ninety pounds. After some thought, however, the children realized that this was an unfair distribution because the ranges among the categories were different: nine pounds for "light," fourteen pounds for "medium" and nineteen pounds for "heavy."

In order to determine equal ranges for all three categories, we calculated the total range of weights, which was forty-seven pounds. Then we divided the total range by three categories; a fifteen-pound range for each weight category was agreed upon. With the new range ("light," forty-five to sixty pounds; "medium," sixty-one to seventy-six pounds; "heavy," seventy-seven to ninety-two pounds) there were two heavy, thirteen medium, and ten light students in the class.*

The class next investigated body characteristics. While gathering the various body measurements the children were involved in using different measuring instruments and units of measure. Each child was given a list of body parts to measure. These parts required either a circumferential measurement (e.g., distance around the neck or waist) or a linear measurement (e.g., length of leg from kneecap to

*The class could determine the weight categories graphically, using a histogram. By picking a range of, say, five pounds for each column, the children could see the distribution of weights. They could then find the median weight and use it as the midpoint of their "medium" category. The "light" and "heavy" categories could be determined according to the gaps in the measurement distribution.--ED.

floor). The children could use one of the following instruments:

yardstick
shoestring
ruler
calipers (made from tagboard)
tape measure

Before dividing into groups, each group using one of the above instruments, we went through the list of body parts to clarify the locations of various parts, such as where the waist was. The children felt their bones, such as the pelvis, shoulder bone, and kneecap, which I pointed out as being good end points from which to start or end a measurement.

The groups worked for about ten minutes trying to measure the body parts on their list with their instrument. The group with the pair of calipers could not figure out how to measure with it; no one thought of using them in conjunction with a yardstick. The group with the yardstick could not figure out how to measure the distance from ear to ear. They claimed that "the yardstick would not go through their heads!" In the tape measure group one boy measured everyone. Everyone's neck circumference measured forty-nine inches, which went uncontested. When I asked the groups to finish their measurements, the children with the shoestring were still undecided as to whether they could even begin measuring with it.

During the class discussion that followed, each group explained the limitations of the measuring instrument they had used. The calipers were demonstrated by me, after which everyone wanted the distance from ear to ear to be measured. The children with the shoestring explained that they could not measure anything because there were no numbers written on it. My suggestion of measuring in shoestring units brought laughter. We talked about how arbitrary units of measure were. Eventually the class saw that as long as everyone used the same unit of measure, the various measurements could be compared.

We also discussed measurement accuracy. This topic arose when we noted that Jim's neck circumference was forty-nine inches and his waist circumference was twenty-four inches. When the measurer was questioned, it was learned that he had used the wrong end of the tape measure to measure the neck circumference.

Since there had been arguments over eye color, we decided to find out more about our facial characteristics in

general. To aid each student, small hand mirrors were distributed. The children noted such characteristics as eye color, eye shape, hair color, hair length, distinguishing facial characteristics such as freckles or dimples, thin or thick lips, thick or thin eyebrows.

Later the children wanted to use their measurement skills to measure various parts of their heads and to graph these measurements. They used rulers, tape measures, and homemade calipers to determine such measurements as distance from the top of the head to the temple and cheekbone. Figure C2-2 shows one child's measurements.

Before a picture of their heads could be drawn, the measurements had to be scaled down. We decided that each square on the graph paper would represent one-fourth of an inch. This was not a difficult concept for them to grasp because we had been working on our multiplication tables of fours. A center line was drawn down the middle of the graph paper. We decided that it would be easier to graph the facial measurements if everyone had a base line from which to start; half of the face would be on one side of the base line, the other half on the other side of the line. This plan required that they divide each measurement by two. The concept of one-half was difficult for them to understand at first. I then showed them that one-half was simply two-fourths. It was interesting to see them figure out that an uneven number could be divided in half if one subtracted one, divided the resulting even number by two, and then added one-half. (See Figure C2-2 for one child's calculations.)

The face drawings took several weeks to complete. The children were fascinated at watching their drawings develop. The shape of the head was drawn first, then eyes and eyebrows were drawn in relation to the temple. Nose and mouth came next. Finally, hair and ears were drawn. Most of the pictures captured enough of each child so that the children could be picked out from them. Figure C2-3 shows one girl's drawing.

In our next session we compared the proportion of head size to head length. The children paired off and then took turns measuring the circumference of their heads at the temples. They also measured the distance from the top of the head to beneath the chin, using our homemade calipers. Their measurements appear at left.

Each child's head measurements were then plotted on half-inch graph paper, where each half-inch square represented one inch of the head measurement. When all the points were plotted, the students drew a line from each point to the

Head circumference at temples	Length from top of head to beneath chin
21"	5"
20"	5 1/4"
21 1/4"	5 1/4"
19"	5 1/2"
21"	5 1/2"
20"	5 3/4"
20"	6"
21"	6"
20 1/2"	6 1/4"
21"	6 1/4"
20"	6 1/2"
21 1/4"	6 1/2"
22"	6 1/2"
19"	6 3/4"
20"	7"
20 1/2"	7"
21"	7"
21"	7 1/2"
22"	8"

Name Brenda

Distance from top of head to	No. of inches	No. of squares	÷ by 2	Distance between	No. of inches	No. of squares	÷ by 2
Temple	2¾	11	5½	Temples	4	16	8
Cheek bone	4	16	8	Cheek bones	4	16	8
jaw bone	5¾	23	11½	Jaw bone	4	16	8
Chin	7	28	14	Chin	1¾	7	3½
Distance from top of head to				**Width of**			
Eye brow (top)	2¾	11	5½	Eye brow Distance apart	1⅜	5	2½
Eyes (position)				Eyes Distance apart	1⅜	5	2½
Length of nose (position)	1½	6	3	Nostrils	1	4	2
Distance from bottom of chin to Lower lip	1¼	5	2½	Mouth (shape)	¾	~~3~~	1½
Ears (position)	4	16	8	Length of ear	1¾	7	3½
					2	8	4

Figure C2-2

Figure C2-3

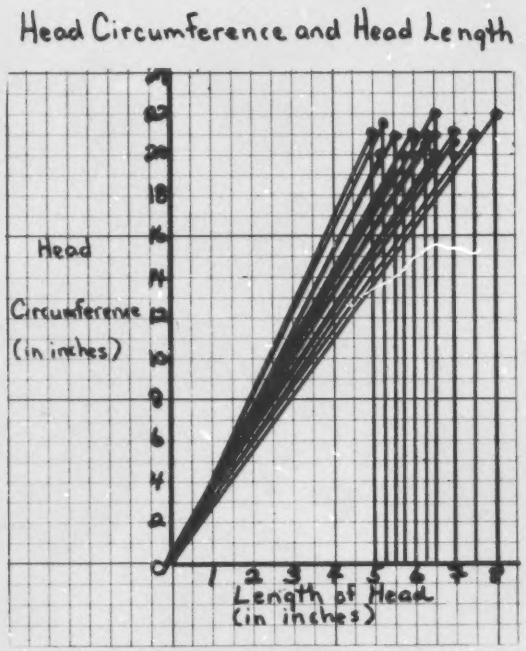


Figure C2-4

graph origin and another line from each point to the X axis. Figure C2-4 shows the resulting graph.*

Afterwards, I thought that one-inch graph paper would have been better to use; the points would not have been so close together and the children would have been able to compare the slopes of the lines more easily.

The day before spring vacation, one girl came to tell me that two boys had stopped her and two other girls in the hall and offered them drugs. Before they could do anything, the boys ran off. Upon further questioning I found that they had gone to the principal to report this incident; therefore, I did not pursue the matter any further. However, I did ask whether they knew who the boys were. She told me that she did not know them but could describe the one who had offered them the drugs. "He was tall, blond-haired, with a big smile and wore a bright yellow sweater." This description fit perfectly one sixth grader I knew.

After spring vacation we spent more time testing the effectiveness of our descriptions. During one of our sessions we played the Sit-Down Game.

To write the descriptions, the children were paired and sat back to back. When I said "go," they turned and looked for one minute at their partner. When I said "stop," they turned around and wrote for two minutes all they could on the partner's physical characteristics. They spent another minute describing the partner's clothing. Upon completion, each child put at the bottom of his sheet the described person's name. Figure C2-5 shows one child's description of his partner.

Using these descriptions, we played the Sit-Down Game. When a child was correctly identified, I put an asterisk by the characteristic that had singled him out. Later, we made a histogram, shown in Figure C2-6, to note the number of children who were identified using different numbers of characteristics.**

*This type of graph is a slope diagram (formerly called triangle diagram) and is a good way to compare fractions or ratios. By comparing the slope of the hypotenuse the children can determine whether a person has a fat face or a thin face. The steeper the hypotenuse (see Figure C2-4) the fatter the face. The "average" face can be found by identifying the middle or median hypotenuse.--ED.

**To determine whether fewer characteristics would identify a child, the class could make Venn diagrams using their list of characteristics.--ED.

Troy

1. black hair
2. brown eyes
3. hafs freckls

1. brown shirt
2. red pants
3. Blue shoes

Cheryl

Figure C2-5

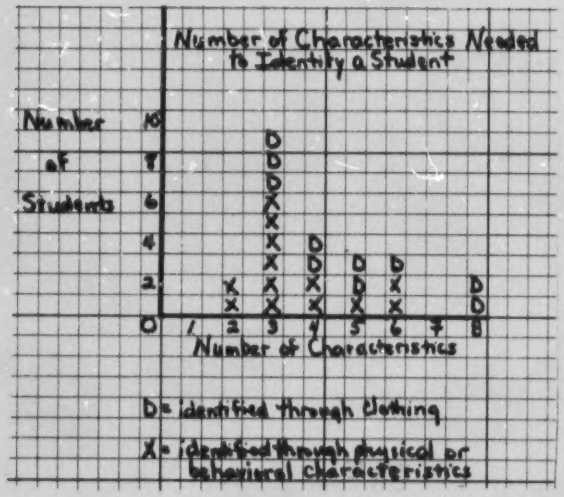

Number of Characteristics Needed to Identify a Student
Number of Students
Number of Characteristics
D= identified through clothing
X= identified through physical or behavioral characteristics

Figure C2-6

The children determined that eleven children were identified through a physical characteristic (e.g., eye color, skin color, weight), ten students were identified through clothing, two students were identified by behavior characteristics (e.g., funny, always gets into trouble), and three students were not identified at all. The class also noted that the first characteristic in seventeen descriptions was either hair color or hair style.

The children were enthusiastic about playing the game. Everyone was reluctant to sit down. At one point one student chided another, "You can't be both tall and short. When you measured yourself, you said you were tall so that you could stand up. Now you say you're medium."

"But he can be medium. If you're not tall and not short, then you're medium."

The following week the class tried to identify someone from another class. I composed the description and told the class that I would tell them anything they wanted to know about this student. They were to keep a tally of the number of clues it took for identification.

The first two clues they wanted to know were sex of the student and the student's hair color and length. I told them that the student was a boy with short, light-brown hair. We went to the other classroom where all of the students had name tags on their desks. My students looked carefully at the students; a few walked around for a closer look.

After a few minutes everyone wrote down whom he thought had short, light-brown hair. We quickly tallied the votes. There were six possible choices.

Boy	Number of Votes
Jim	4
Brad	9
Gary	6
Jeff	2
Mike	2
Loren	1

Mike was eliminated after the class agreed that his hair color was more black than brown.

The third characteristic pertained to the boy's size. I told the class that he was of medium size. Automatically, Jim was eliminated because he was considered large. Loren was decided as being small and was also eliminated.

The class then requested to know the boy's facial shape.

I told them that the boy had an oval-shaped face. Most of the students could not distinguish between the various face shapes. However, six students felt that they knew the three remaining boys well enough to venture a guess. Six of the eight votes went to Brad as having an oval face. Two votes went to Gary, and Jeff received no votes.

When the class was given the fifth clue, hazel eyes, Brad was positively identified.

When we returned to our classroom, we talked about other useful and not so useful characteristics. For example, the class felt that someone could be quickly identified if they knew that the person was the tallest or the shortest, thinnest or fattest student in the class.* They also felt that a person's name was not necessarily a distinguishing characteristic because with a name such as Jackie, the student could be either a girl or a boy. Also, there might be more than one student by the name of Jackie.

The following week the class had the opportunity to compose a description under "stress" conditions. During class one day we were suddenly interrupted by a banging at the door. The door flew open and in stormed a man who was looking for our class observer. He loudly accused her of running his motorcycle off the road. It took all my "muscle" to pull him out of the room and down the hall. You could have heard a pin drop when I returned to class. The children were completely aghast at this sudden incident. I heaved a sigh, looked at them, and said, "Write a description of him." Suddenly everyone was talking. I had to set a time limit to get them writing. After about five minutes, I collected their descriptions, and we continued with what we had been doing.

After a while when class activities were back to normal, the man returned to the class where he was introduced. He chatted with the children for ten minutes and then left. Then I had the class write another description of him.

To compare what the children noticed under stress and relaxed situations we made bar graphs of the characteristics the children had included in their descriptions after the incident and after his introduction. We decided to use "X's" to indicate the number of characteristics seen immediately after the incident and to use "O's" to indicate

*The class might discuss if the same person would be the tallest (shortest, thinnest) in any group he was a part of. --ED.

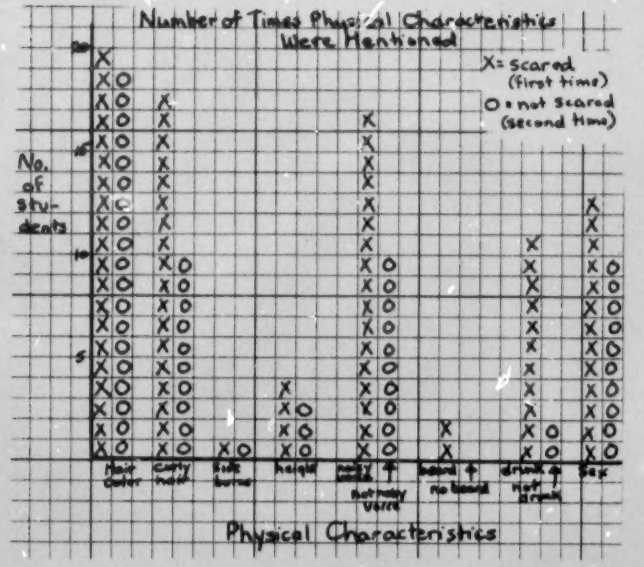

Number of Times Physical Characteristics Were Mentioned
X= scared (first time)
O= not scared (second time)
No. of students
Physical Characteristics

Figure C2-7

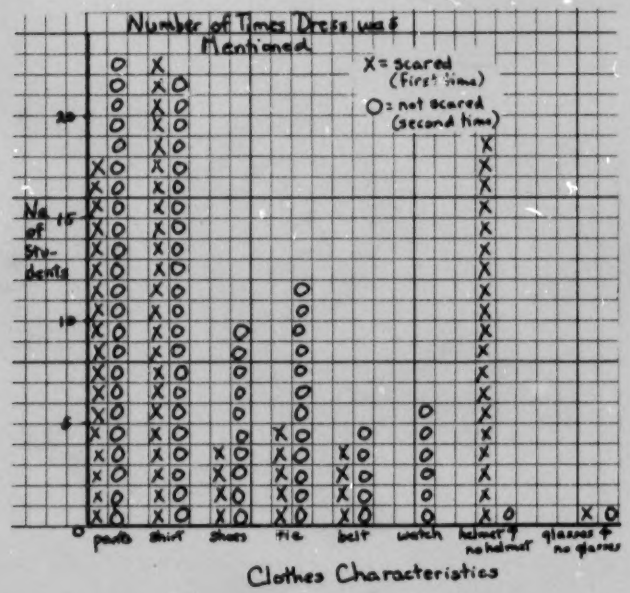

Number of Times Dress was Mentioned
X= scared (first time)
O= not scared (second time)
No. of students
Clothes Characteristics

Figure C2-8

the number of characteristics seen later after Paul's introduction. One graph (see Figure C2-7) showed the number of times different physical characteristics were included in the children's descriptions. The other graph (see Figure C2-8) showed the number of times various items of clothing were recorded. Figure C2-9 shows Paul's description of himself.*

The children themselves interpreted the graphs. They compared the number of children who included a characteristic in their descriptions just after the incident and after Paul's introduction to the class. For example, more children noticed Paul's shirt the second time in the room than the first time.

For the remaining few weeks of school we continued to examine physical characteristics through various Designing for Human Proportions activities.

*The class could compare their descriptions to Paul's description of himself. For each characteristic mentioned in Paul's description the children could plot and compare the number of errors in their descriptions.--ED.

Paul Kacanek's Self Description

Immediately After Incident

- auburn hair (disheveled)
- sideburns
- brown eyes
- blue shirt
- ivory denim pants
- white sneakers (red & blue stripes)
- watch (black expandable bracelet)
- brown tie (blue & gold stripes)
- dark sunglasses
- carrying motorcycle helmet
- height: 5' 9 1/2"
- brown belt
- unloosened tie
- unbuttoned shirt, hanging out
- loud and obnoxious
- paid no attention to students
- banged door, barged in

Second Time (Introduced to Students)

- hair combed
- shirt tucked in
- tie straightened
- talked to teacher, observer and students
- friendly
- happy
- no motorcycle helmet
- no sunglasses

Figure C2-9

D. References

1. LIST OF "HOW TO" CARDS

Below are listed the current "How To" Card titles that students working on the Describing People challenge might find useful. A complete listing of both the "How To" Cards and the Design Lab "How To" Cards is contained in the USMES Guide. In addition, the Design Lab Manual contains the list of Design Lab "How To" Cards.

GRAPHING

- GR 1 How to Make a Bar Graph Picture of Your Data
- GR 2 How to Show the Differences in Many Measurements or Counts of the Same Thing by Making a Histogram
- GR 3 How to Make a Line Graph Picture of Your Data
- GR 4 How to Decide Whether to Make a Bar Graph Picture or a Line Graph Picture of Your Data
- GR 5 How to Find Out If There is Any Relationship Between Two Things by Making a Scatter Graph
- GR 6 How to Make Predictions by Using a Scatter Graph

MEASUREMENT

- M 2 How to Measure Distances
- M 9 How to Make a Conversion Graph to Use in Changing Measurements from One Unit to Another Unit
- M 10 How to Use a Conversion Graph to Change *Any* Measurement in One Unit to Another Unit

PROBABILITY AND STATISTICS

- PS 2 How to Record Data by Tallying
- PS 3 How to Describe Your Set of Data by Finding the Average
- PS 4 How to Describe Your Set of Data by Using the Middle Piece (Median)
- PS 5 How to Find the Median of a Set of Data from a Histogram

RATIOS, PROPORTIONS, AND SCALING

- R 1 How to Compare Fractions or Ratios by Making a Triangle Diagram*

*Presently called Slope Diagram.

New titles to be added in 1976:

How to Round Off Data
How to Make and Use a Cumulative Distribution Graph

A cartoon-style set of "How To" Cards for primary grades is being developed from the present complete set. In most cases titles are different and contents have been rearranged among the various titles. It is planned that this additional set will be available early in 1977.

2. LIST OF BACKGROUND PAPERS

As students work on USMES challenges, teachers may need background information that is not readily accessible elsewhere. The Background Papers fulfill this need and often include descriptions of activities and investigations that students might carry out.

Below are listed titles of current Background Papers that teachers may find pertinent to Describing People. The papers are grouped in the categories shown, but in some cases the categories overlap. For example, some papers about graphing also deal with probability and statistics.

The Background Papers are being revised, reorganized, and rewritten. As a result, many of the titles will change.

GRAPHING

GR 3 Using Graphs to Understand Data by Earle Lomon
GR 6 Using Scatter Graphs to Spot Trends by Earle Lomon
GR 7 Data Gathering and Generating Graphs at the Same Time (or Stack 'Em and Graph 'Em at One Fell Swoop!) by Edward Liddle

GROUP DYNAMICS

GD 2 A Voting Procedure Comparison That May Arise in USMES Activities by Earle Lomon

MEASUREMENT

M 3 Determining the Best Instrument to Use for a Certain Measurement by USMES Staff

PROBABILITY AND STATISTICS

PS 4 Design of Surveys and Samples by Susan J. Devlin and Anne E. Freeny
PS 5 Examining One and Two Sets of Data Part I: A General Strategy and One-Sample Methods by Lorraine Denby and James Landwehr

RATIOS, PROPORTIONS, AND SCALING

R 1 Graphic Comparison of Fractions by Merrill Goldberg
R 2 Geometric Comparison of Ratios by Earle Lomon

3. BIBLIOGRAPHY OF NON-USMES MATERIALS

The following books are references that may be of some use during work on Describing People. The teacher is advised to check directly with the publisher regarding current prices. A list of references on general mathematics and science topics can be found in the *USMES Guide*.

Books for Teachers

Elementary Science Study (ESS). *Attribute Games and Problems*. Webster/McGraw-Hill, Manchester Road, Manchester, Missouri 63011. The unit includes Teacher's Guide for *Attribute Games and Problems* ($6.48), "A" Blocks, Color Cubes and People Pieces ($9.60), Problem Cards for the unit ($9.20).

This ESS unit is concerned with classification and the relationships between categories.

Minnesota Mathematics and Science Teaching Project (Minnemast). *Describing and Classifying* (Unit 3). *Observing Properties* (Unit 8). Minnemast, 720 Washington Avenue S.E., Minneapolis, Minnesota 55414. 1967.

Both include interesting ways to introduce sorting, describing, and classifying to very young children.

4. GLOSSARY

The following definitions may be helpful to a teacher whose class is investigating the Describing People challenge. Some of the words are included to give the teacher an understanding of technical terms; other are included because they are commonly used throughout the resource book.

These terms may be used when they are appropriate for the children's work. For example, a teacher may tell the children that when they conduct surveys, they are collecting *data*. It is not necessary for the teacher or students to learn the definitions nor to use all of these terms while working on their challenge. Rather, the children will begin to use the words and understand the meanings as they become involved in their investigations.

Average	The numerical value obtained by dividing the sum of the elements of a set of data by the number of elements in that set. Also called the mean.
Complement of a Set	See *Set*.
Conversion	A change from one form to another. Generally associated in mathematics and science with the change from one unit of measure to another or the change from one form of energy to another.
Correlation	A relationship between two sets of data.
Data	Any facts, quantitative information, or statistics.
Distribution	The spread of data over the range of possible results.
Event	A happening; an occurrence; something that takes place. Example: identification of a child using four characteristics.
Frequency	The number of times a certain event occurs in a given unit of time or in a given total number of events. Example: the number of children who were identified using four characteristics.
Graph	A drawing or a picture of one or several sets of data.

Bar Graph

A graph of a set of measures or counts whose sizes are represented by the vertical (or horizontal) lengths of bars of equal widths. Example: the number of children with brown, black, blond, and red hair color.

Hair Color	Number of Children
brown	10
black	6
blond	4
red	2

A bar graph that is represented by circles, triangles, or crosses with lines connecting them so that it has the appearance of a line graph is called a *line chart* (see *Line Graph*). This is a useful representation when two or more sets of data are shown on the same graph.

Conversion Graph

A line graph that is used to change one unit of measurement to another. For example, changing feet to yards.

Yards	Feet
1	3
2	6
3	9
4	12

Cumulative Distribution Graph

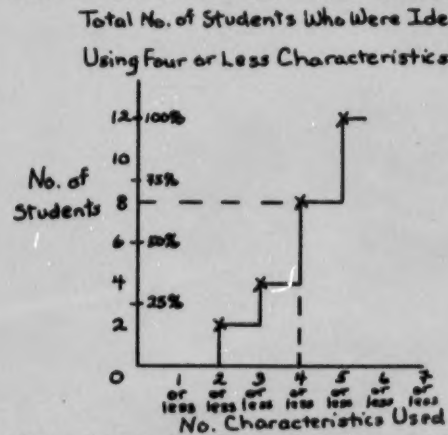
A graph that can be constructed from a histogram by computing running totals from the histogram data. The first running total is the first value in the histogram data (see table of values). The second running total is the sum of the first and second values of the histogram, the third is the sum of the first, second, and third values, and so on. The horizontal scale on the graph is similar to that of the histogram; the vertical scale goes from 0 to the total number of events observed or samples taken (in the example, the total number of students who were

identifiei using four or less characteristics.

Each vertical distance on the graph shows the running total of the number of samples taken that are less than or equal to the value shown on the horizontal scale; thus the graph below indicates that eight students or about 72% of the students were identified with four or less characteristics.

Table of Values

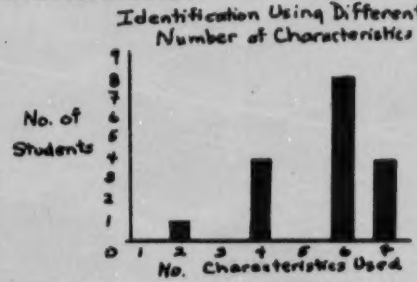
No. of Characteristics	Running Totals
2 or less	2
3 or less	4
4 or less	8
5 or less	12



Histogram

A type of bar graph that shows the distribution of the number of times that different measures or counts of the same event have occurred. A histogram always shows ordered numerical data on the horizontal axis. Example: the different number of children who were identified using a different number of characteristics.

No. Characteristics Used	No. of Students
2	1
4	4
6	8
7	4



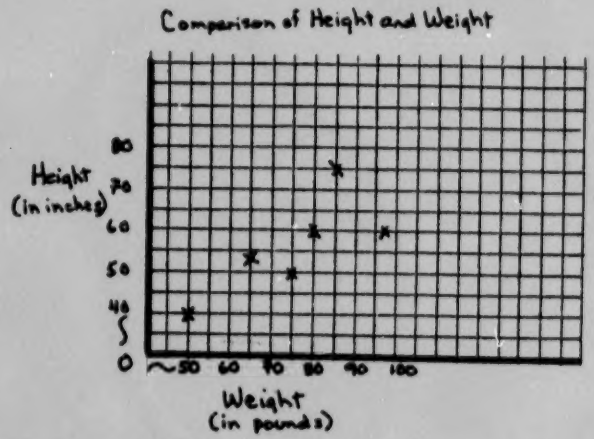
Line Graph

A graph in which a smooth line or line segments pass through or near points representing members of a set of data. Since the line represents an infinity of points, the variable on the horizontal axis must be continuous. If the spaces between the markings on the horizontal axis have no meaning, then the graph is not a line graph, but a a line chart.

Scatter Graph

A graph showing a scatter of points, each of which represents two characteristics of the same thing. For example, in the graph below, each point represents one child; the position of the point indicates the child's height and weight.

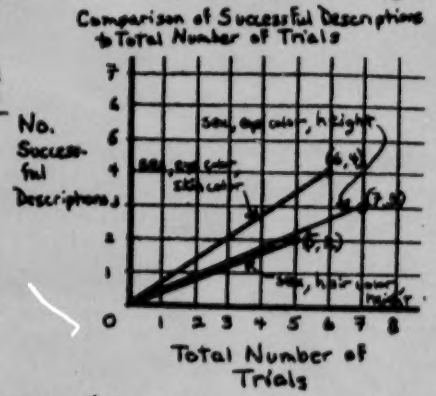
Height	Weight
58	65
40	50
50	75
60	80
75	85
97	60



*Slope Diagram**

A graphical means of comparing fractions or ratios. To represent the ratio a/b, plot the point (b,a) and draw a line from (b,a) to the origin, (0,0). The slope of this line represents the ratio a/b. By comparing slopes of several lines, different ratios can be compared; the steeper the line, the larger the ratio. For example, in the diagram showing the ratio of successful descriptions to total number of trials using different characteristics, the ratio of successful descriptions to total number of trials using the characteristics of sex, eye color, skin color is larger than the ratios for the characteristics of sex, eye color, height and sex, hair color, height.

Characteristics Used	Total No. Trials	No. Successful Descriptions
Sex, eye color, skin color	6	4
Sex, eye color, height	7	3
Sex, hair color, height	5	2



*Formerly labeled triangle diagram.

Histogram	See *Graph*.
Hypothesis	A tentative conclusion made in order to test its implications or consequences.
Intersection of Sets	See *Set*.
Mean	See *Average*.
Median	The middle value of a set of data in which the elements have been ordered from smallest to largest. The median value has as many elements above it as below it.
Mode	The element or elements in a set of data that occur most often.
Ordered Set	A set of data arranged from smallest to largest.
Per Cent	Literally per hundred. A ratio in which the denominator is always 100, e.g., 72 percent = 72/100 = 0.72 = 72%, where the symbol % represents 1/100.
Percentage	A part of a whole expressed in hundredths.
Proportion	A statement of equality of two ratios, i.e., the first term divided by the second term equals the third term divided by the fourth term, e.g., 5/10 = 1/2. Also a synonym for ratio: when two quantities are in direct proportion, their ratios are the same.
Quartile	
First	The first quartile is the value of the quarter-way piece of data in an ordered set of data.
Third	The third quartile is the value of the three-quarter-way piece of data in an ordered set of data.
Interquartile Range	The range or length of the middle 50% of an ordered set of data; the difference between the first and third quartile.
Range	Mathematical: the difference between the smallest and the largest values in a set of data.
Rank	To order the members of a set according to some criterion, such as size or importance. Example: to arrange height data from shortest to tallest.

Ratio	The quotient of two denominate numbers or values indicating the relationship in quantity, size, or amount between two different things. For example, the ratio of number of successful descriptions to the total number of trials might be expressed as: $\frac{\text{successful descriptions}}{\text{total no. of trials}}$ or successful descriptions: total no. of trials.
Sample	A representative fraction of a population studied to gain information about the whole population.
Sample Size	The number of elements in a sample.
Set	A collection of characteristics, persons, or objects. Each thing in a set is called a member or an element.
Set Theory	The branch of mathematics that deals with the nature and relations of sets.
Complement of a Set	The set of all elements in the universal set but not in the given set. For example, if the universal set is the set of all students in a class, then the set of girls is the complement of the set of boys.
Intersection of Sets	The set of elements common to two or more sets. For example, if set A is all girls and set B is all blue-eyed children, the intersection of set A and set B is the set of blue-eyed girls.
Universal Set	A set that contains all elements relevant to a particular problem.
Venn Diagram	A drawing used to illustrate the relationship between sets.
Statistics	The science of drawing conclusions or making predictions using a collection of quantitative data.
Tally	A visible record used to keep a count of some set of data, especially a record of the number of times one or more events occur. Example: number of successful descriptions using five characteristics.

E. Skills, Processes, and Areas of Study Utilized in Describing People

The unique aspect of USMES is the degree to which it provides experience in the process of solving real problems. Many would agree that this aspect of learning is so important as to deserve a regular place in the school program even if it means decreasing to some extent the time spent in other important areas. Fortunately, real problem solving is also an effective way of learning many of the skills, processes, and concepts in a wide range of school subjects.

On the following pages are five charts and an extensive, illustrative list of skills, processes, and areas of study that are utilized in USMES. The charts rate Describing People according to its potential for learning in various categories of each of five subject areas--real problem solving, mathematics, science, social science, and language arts. The rating system is based on the amount that each skill, process, or area of study within the subject areas is used--extensive (1), moderate (2), some (3), little or no use (-). (The USMES Guide contains a chart that rates all USMES units in a similar way.)

The chart for real problem solving presents the many aspects of the problem-solving process that students generally use while working on an USMES challenge. A number of the steps in the process are used many times and in different orders, and many of the steps can be performed concurrently by separate groups of students. Each aspect listed in the chart applies not only to the major problem stated in the unit challenge but also to many of the tasks each small group undertakes while working on a solution to the major problem. Consequently, USMES students gain extensive experience with the problem-solving process.

The charts for mathematics, science, social science, and language arts identify the specific skills, processes, and areas of study that may be learned by students as they respond to a Describing People challenge and become involved with certain activities. Because the students initiate the activities, it is impossible to state unequivocally which activities will take place. It is possible, however, to document activities that have taken place in USMES classes and identify those skills and processes that have been used by the students.

Knowing in advance which skills and processes are likely to be utilized in Describing People and knowing the extent that they will be used, teachers can postpone the teaching

of those skills in the traditional manner until later in the year. If the students have not learned them during their USMES activities by that time, they can study them in the usual way. Further, the charts enable a teacher to integrate USMES more readily with other areas of classroom work. For example, teachers may teach fractions during math period when fractions are also being learned and utilized in the students' USMES activities. Teachers who have used USMES for several successive years have found that students are more motivated to learn basic skills when they have determined a need for them in their USMES activities. During an USMES session the teacher may allow the students to learn the skills entirely on their own or from other students, or the teacher may conduct a skill session as the need for a particular skill arises.

Because different USMES units have differing emphases on the various aspects of problem solving and varying amounts of possible work in the various subject areas, teachers each year might select several possible challenges, based on their students' previous work in USMES, for their class to consider. This choice should provide students with as extensive a range of problems and as wide a variety of skills, processes, and areas of study as possible during their years in school. The charts and lists on the following pages can also help teachers with this type of planning.

Some USMES teachers have used a chart similar to the one given here for real problem solving as a record-keeping tool, noting each child's exposure to the various aspects of the process. Such a chart might be kept current by succeeding teachers and passed on as part of a student's permanent record. Each year some attempt could be made to vary a student's learning not only by introducing different types of challenges but also by altering the specific activities in which each student takes part. For example, children who have done mostly construction work in one unit may be encouraged to take part in the data collection and data analysis in their next unit.

Following the rating charts are the lists of explicit examples of real problem solving and other subject area skills, processes, and areas of study learned and utilized in Describing People. Like the charts, these lists are based on documentation of activities that have taken place in USMES classes. The greater detail of the lists allows teachers to see exactly how the various basic skills, processes, and areas of study listed in the charts may arise in Describing People.

The number of examples in the real problem solving list have been limited because the list itself would be unreasonably long if all the examples were listed for some of the categories. It should also be noted that the example(s) in the first category--*Identifying and Defining Problems*--have been limited to the major problem that is the focus of the unit. During the course of their work, the students will encounter and solve many other, secondary problems, such as the problem of how to display their data or how to draw a scale layout.

Breaking down an interdisciplinary curriculum like USMES into its various subject area components is a difficult and highly inexact procedure. Within USMES the various subject areas overlap significantly, and any subdivision must be to some extent arbitrary. For example, where does measuring as a mathematical skill end and measurement as a science and social science process begin? How does one distinguish between the processes of real problem solving, of science, and of social science? Even within one subject area, the problem still remains--what is the difference between graphing as a skill and graphing as an area of study? This problem has been partially solved by judicious choice of examples and extensive cross-referencing.

Because of this overlap of subject areas, there are clearly other outlines that are equally valid. The scheme presented here was developed with much care and thought by members of the USMES staff with help from others knowledgeable in the fields of mathematics, science, social science, and language arts. It represents one method of examining comprehensively the scope of USMES and in no way denies the existence of other methods.

REAL PROBLEM SOLVING	Overall Rating
Identifying and defining problem.	1
Deciding on information and investigations needed	1
Determining what needs to be done first, setting priorities.	2
Deciding on best ways to obtain information needed.	1
Working cooperatively in groups on tasks.	1
Making decisions as needed.	1
Utilizing and appreciating basic skills and processes.	1
Carrying out data collection procedures--opinion surveying, researching, measuring, classifying, experimenting, construction.	1
Asking questions, inferring.	1
Distinguishing fact from opinion, relevant from irrelevant data, reliable from unreliable sources.	1
Evaluating procedures used for data collection and analysis. Detecting flaws in process or errors in data.	1

REAL PROBLEM SOLVING	Overall Rating
Organizing and processing data or information.	1
Analyzing and interpreting data or information.	1
Predicting, formulating hypotheses, suggesting possible solutions based on data collected.	1
Evaluating proposed solutions in terms of practicality, social values, efficacy, aesthetic values.	1
Trying out various solutions and evaluating the results, testing hypotheses.	1
Communicating and displaying data or information.	1
Working to implement solution(s) chosen by the class.	1
Making generalizations that might hold true under similar circumstances; applying problem-solving process to other real problems.	1

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use

MATHEMATICS	Overall Rating
Basic Skills	
Classifying/Categorizing	1
Counting	1
Computation Using Operations	
Addition/Subtraction	1
Multiplication/Division	3
Fractions/Ratios/Percentages	3
Business and Consumer Mathematics/ Money and Finance	-
Measuring	1
Comparing	1
Estimating/Approximating/Rounding Off	1
Organizing Data	1
Statistical Analysis	2
Opinion Surveys/Sampling Techniques	-
Graphing	2
Spatial Visualization/Geometry	2
Areas of Study	
Numeration Systems	3
Number Systems and Properties	2
Denominate Numbers/Dimensions	1
Scaling	-
Symmetry/Similarity/Congruence	3
Accuracy/Measurement Error/ Estimation/Approximation	1
Statistics/Random Processes/Probability	2
Graphing Functions	2
Fraction/Ratio	3
Maximum and Minimum Values	3
Equivalence/Inequality/Equations	1
Money/Finance	-
Set Theory	1

SCIENCE	Overall Rating
Processes	
Observing/Describing	1
Classifying	1
Identifying Variables	1
Defining Variables Operationally	1
Manipulating, Controlling Variables/ Experimenting	3
Designing and Constructing Measuring Devices and Equipment	3
Inferring/Predicting/Formulating, Testing Hypotheses/Modeling	1
Measuring/Collecting, Recording Data	1
Organizing, Processing Data	1
Analyzing Interpreting Data	1
Communicating, Displaying Data	1
Generalizing/Applying Process to New Problems	1
Areas of Study	
Measurement	2
Motion	-
Force	3
Mechanical Work and Energy	-
Solids, Liquids, and Gases	-
Electricity	-
Heat	-
Light	-
Sound	-
Animal and Plant Classification	-
Ecology/Environment	-
Nutrition/Growth	-
Genetics/Heredity/Propagation	2
Animal and Plant Behavior	-
Anatomy/Physiology	2

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use

SOCIAL SCIENCE	Overall Rating
Process	
Observing/Describing/Classifying	1
Identifying Problems, Variables	1
Manipulating, Controlling Variables/ Experimenting	3
Inferring/Predicting/Formulating, Testing Hypotheses	2
Collecting, Recording Data/Measuring	1
Organizing, Processing Data	1
Analyzing, Interpreting Data	1
Communicating, Displaying Data	1
Generalizing/Applying Process to Daily Life	2
Attitudes/Values	
Accepting responsibility for actions and results	1
Developing interest and involvement in human affairs	1
Recognizing the importance of individual and group contributions to society	1
Developing inquisitiveness, self-reliance, and initiative	1
Recognizing the values of cooperation, group work, and division of labor	1
Understanding modes of inquiry used in the sciences, appreciating their power and precision	1
Respecting the views, thoughts, and feelings of others	1
Being open to new ideas and information	1
Learning the importance and influence of values in decision making	1
Areas of Study	
Anthropology	2
Economics	-
Geography/Physical Environment	-
Political Science/Government Systems	-
Recent Local History	-
Social Psychology/Individual and Group Behavior	-
Sociology/Social Systems	3

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LANGUAGE ARTS	Overall Rating
Basic Skills	
Reading:	
Literal Comprehension: Decoding Words, Sentences, Paragraphs	2
Critical Reading: Comprehending Meanings, Interpretation	3
Oral Language	
Speaking	1
Listening	1
Memorizing	-
Written Language	
Spelling	3
Grammar: Punctuation, Syntax, Usage	3
Composition	3
Study Skills	
Using References and Resources	3
Outlining/Organizing	3
Attitudes/Values	
Appreciating the value of expressing ideas through speaking and writing	1
Appreciating the value of written resources	3
Developing an interest in reading and writing	3
Making judgments concerning what is read	3
Appreciating the value of different forms of writing, different forms of communication	1

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use

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REAL PROBLEM SOLVING IN DESCRIBING PEOPLE

Identifying and Defining Problems	• Students note that it is hard to find someone on the playground using someone else's description. • Students agree that it is hard to describe someone so that the person can be quickly and easily found. • See also SOCIAL SCIENCE list: *Identifying Problems, Variables*.
Deciding on Information and Investigations Needed	• Students list characteristics that they feel should be included in a description. • Students investigate ways lost or wanted people are described by the missing persons bureau and the Federal Bureau of Investigation.
Determining What Needs to Be Done First, Setting Priorities	• Students determine that some characteristics (e.g., hair color, height, weight, size) need clarification before they try out more descriptions.
Deciding on Best Ways to Obtain Information Needed	• Students decide that the best way to determine whether they are tall, medium or short is to measure everyone in the class and to group the measurements. • Students decide that they can use the nurse's scale to measure students' weights.
Working Cooperatively in Groups on Tasks	• Students work in groups to take measurements.
Making Decisions as Needed	• Students decide to tally the number of children who were identified using different numbers of characteristics. • Students decide on the best combination of three, four or more characteristics to include in a description.
Utilizing and Appreciating Basic Skills and Processes	• Students draw histograms of their height and weight data. • Students divide one-, two-, or three-digit whole numbers to determine the mean height or weight. • Students construct measuring instruments (e.g., calipers) in the Design Lab.

Utilizing and Appreciating Basic Skills and Processes (cont.)

- Students identify variations in measurement data due to measuring instrument variations as something that can change in an experiment.
- Students observe differing and like physical characteristics.
- Students tally opinion survey data on physical characteristics.
- Students increase and clarify their vocabulary as they write descriptions.
- Students write letters to various agencies to share their findings.
- See also MATHEMATICS, SCIENCE, SOCIAL SCIENCE, and LANGUAGE ARTS lists.

Carrying Out Data Collection Procedures--Opinion Surveying, Researching, Measuring, Classifying, Experimenting, Constructing

- Students classify people in more than one way, e.g., by age, sex, grade level, race.
- Students measure heights and weights.
- See also MATHEMATICS list: *Classifying/Categorizing; Measuring.*
- See also SCIENCE list: *Observing/Describing; Classifying; Manipulating, Controlling Variables/Experimenting; Designing and Constructing Measuring Devices and Equipment; Measuring/Collecting, Recording Data.*
- See also SOCIAL SCIENCE list: *Observing/Describing/Classifying; Manipulating, Controlling Variables/Experimenting; Collecting, Recording Data/Measuring.*

Asking Questions, Inferring

- Students ask whether there are more tall students than short students. They infer from their histogram that there are more short than tall students in the class.
- See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses/Modeling.*
- See also SOCIAL SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*

Distinguishing Fact from Opinion, Relevant from Irrelevant Data, Reliable from Unreliable Sources

- Students recognize that the police department and bureau of missing persons are reliable sources for information on ways to describe people.
- Students decide that some characteristics are irrelevant in identifying a person, e.g., whether the person owns pets or not.

Evaluating Procedures Used for Data Collection and Analysis, Detecting Flaws in Process or Errors in Data	• Students discover that some children wore shoes when being measured for height but others did not. • Students note errors in measurment: that some students who are tall measured to be shorter than those who are medium. • See also MATHEMATICS list: *Estimating/Approximating/ Rounding Off.*
Organizing and Processing Data	• Students record height data on a chart. • Students order and group height data. • See also MATHEMATICS list: *Organizing Data.* • See also SCIENCE and SOCIAL SCIENCE lists: *Organizing, Processing Data.*
Analyzing and Interpreting Data	• Students find mean height and weight. • Students make a scatter graph of height and weight data. • See also MATHEMATICS list: *Comparing; Statistical Analysis; Maximum and Minimum Values; Graphing.* • See also SCIENCE and SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*
Predicting, Formulating Hypotheses, Suggesting Possible Solutions Based on Data Collected	• Students hypothesize that a certain combination of characteristics is more effective in identifying a person. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses/Modeling.* • See also SOCIAL SCIENCE list: *Inferring/Predicting/ Formulating, Testing Hypotheses.*
Evaluating Proposed Solutions in Terms of Practicality, Social Values, Efficacy, Aesthetic Values	• Students discuss the practical use and efficacy of using certain characteristics, such as eye color, hair color, clothes in a description.
Trying Out Various Solutions and Evaluating the Results, Testing Hypotheses	• Students try to identify students in other classes using their list of characteristics. • Students compare their list or combination of characteristics with missing persons descriptions, F.B.I. descriptions. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*

Trying Out Various Solutions and Evaluating the Results, Testing Hypotheses (cont.)	• See also SOCIAL SCIENCE list: *Inferring/Predicting/ Formulating, Testing Hypotheses.*
Communicating and Displaying Data or Information	• Students draw a bar graph to show the number of students with different hair colors. • See also MATHEMATICS list: *Graphing; Scaling.* • See also SCIENCE and SOCIAL SCIENCE lists: *Communicating, Displaying Data.* • See also LANGUAGE ARTS list.
Working to Implement Solution(s) Chosen by the Class	• Students make presentation to other classes to share their findings. • Students write letters to various agencies to share their findings.
Making Generalizations That Might Hold True Under Similar Circumstances; Applying Problem-Solving Process to Other Real Problems	• Students recognize that classroom furniture and fixtures in the various grade levels are different sizes and heights because of physical differences. • Students utilize measuring and graphing skills (acquired while working on the challenge) on other USMES challenges, such as Designing for Human Proportions. • See also SCIENCE list: *Generalizing/Applying Process to New Problems.* • See also SOCIAL SCIENCE list: *Generalizing/Applying Process to Daily Life.*

ACTIVITIES IN DESCRIBING PEOPLE UTILIZING MATHEMATICS

Basic Skills

Classifying/Categorizing	• Establishing categories, such as tall, medium, short for height data. • Using the concepts and language of set theory (e.g., subsets, union, intersection) playing the Rope Circles Game and drawing Venn diagrams. • See also SCIENCE list: *Classifying*. • See also SOCIAL SCIENCE list: *Observing/Describing/Classifying*.
Counting	• Counting number of students with like and unlike characteristics. • Counting number and variety of characteristics used in descriptions. • Counting number of students who were eliminated by a characteristic playing the Sit-Down Game. • Counting number of characteristics needed to identify a student. • Counting to read scales on measuring instruments, such as meter stick, weight scales. • Counting by sets to find scale for graph axes.
Computation Using Operations: Addition/Subtraction	• Adding one-, two-, or three-digit whole numbers to find total tally or total height or weight measurement. • Subtracting one-, two-, or three-digit whole numbers to find differences between predicted and actual height measurements. • Subtracting one-, two-, or three-digit whole numbers to find ranges for height data. • Subtracting one-, two-, or three-digit whole numbers to find measurement differences between students in the class, between students in different grade levels. • Subtracting one-, two-, or three-digit whole numbers to determine the amount measurements deviate from the median or mean measurement.
Computation Using Operations: Multiplication/Division	• Multiplying and dividing one-, two-, or three-digit whole numbers to convert from one unit of measure to another, such as meters to centimeters, inches to centimeters, and vice versa.

Computation Using Operations: Multiplication/Division (cont.)

- Dividing one-, two-, or three-digit whole numbers to determine the mean height, weight.
- Dividing one-, two-, or three-digit whole numbers to determine percentage of students in class with brown, black, red hair color.

Computation Using Operations: Fractions/Ratios/Percentages

- Using mixed numbers in adding, subtracting, or dividing body measurements.
- Changing fractions to higher or lower terms (equivalent fractions) to add, subtract, or divide body measurements.
- Using fractions and ratios to convert from one unit of measure to another, such as centimeters to meters.
- Calculating percentages, such as the percentage of students with blue, brown, hazel eye colors.
- Determining ratios of the various hair colors in the class from a class survey.
- Using slope diagrams to compare ratios and fractions, such as comparing body proportions, number of successful descriptions to total number of trials.
- Using fractions in measurement and graphing of body measurements.

Measuring

- Converting from one unit of measure to another, such as inches to feet, inches to centimeters.
- See also SCIENCE list: *Measuring/Collecting, Recording Data.*
- See also SOCIAL SCIENCE list: *Collecting, Recording Data/Measuring.*

Comparing

- Using the concept of *greater than* and *less than* in making comparisons.
- Comparing quantitative data, such as measurements taken by various students.
- Comparing the mean, mode and median of measurement data.
- Comparing qualitative with quantitative data, such as a student's physical appearance (heavy, average, thin) with his actual height or weight measurements.
- Comparing estimated or predicted measurements with actual body measurements.
- Comparing fractions and ratios using the slope diagram.
- Comparing data graphically, such as a histogram showing the number of students with various weights or a slope diagram to compare the ratio of number of successful trials to total number of trials.

Comparing (cont.)	• See also SCIENCE list: *Analyzing, Interpreting Data.* • See also SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*
Estimating/Approximating/ Rounding Off	• Estimating qualitative characteristics, such as hair, eye, skin color. • Estimating one body measurement from knowledge of another body measurement, such as estimating height from weight. • Determining when a measurement, such as height, is likely to be accurate enough for a particular purpose. • Rounding off measurements while measuring various body parts.
Organizing Data	• Tallying data directly onto a graph form, such as a bar graph, histogram. • Ordering real numbers on a graph axis. • See also SCIENCE and SOCIAL SCIENCE lists: *Organizing, Processing Data.*
Statistical Analysis	• Determining total range of height measurement data. Determining ranges within the tall, medium, short categories of height. • Finding and comparing medians, means and modes of measurement data, such as height and weight data. • Determining how much the various height measurement categories deviate from the mean and median. • Assessing predictability of a larger sample (all fourth graders) based on results from a smaller sample (one fourth-grade class). • See also SCIENCE and SOCIAL SCIENCE lists: *Analyzing, Interpreting Data.*

Graphing	• Using alternative methods of displaying data, such as using a chart form to display hair colors or skin colors.
	• Making a graph form--dividing axes into parts, deciding on an appropriate scale.
	• Representing data on graphs.
	  • Bar graph--number of students with various eye colors.
	  • Conversion graph--converting inches to centimeters.

Graphing (cont.)	• Cumulative distribution graph--percentages of students who were identified using certain numbers of characteristics or less. • Histogram--the number of students who weigh certain amounts (36-40 lbs., 41-45 lbs., 46-50 lbs., 51-55 lbs.) • Scatter graph--height vs. weight measurements. • Slope diagram--comparing ratios of successful description trials to total number of trials using different combinations of characteristics. • Obtaining information from graphs. • See also SCIENCE and SOCIAL SCIENCE lists: *Communicating, Displaying Data*.
Spatial Visualization/Geometry	• Using spatial arrangements to convey information, such as the Rope Circles Game, drawing Venn diagrams.
Areas of Study	
Numeration Systems	• Using the metric system (decimal system) to collect measurement data. • Using the English system (other bases, such as fractions) to collect measurement data. • Using the decimal system in converting centimeters to millimeters or meters. • See *Computation Using Operations: Fractions/Ratios/Percentages*.
Number Systems and Properties	• See *Computation Using Operations: Addition/Subtraction; Multiplication/Division; Fractions/Ratios/Percentages*.
Denominate Numbers/Dimensions	• See *Measuring*.
Symmetry/Similarity/Congruence	• See *Spatial Visualization/Geometry*.
Accuracy/Measurement Error/ Estimation/Approximation	• See *Measuring* and *Estimating/Approximating/Rounding Off*.
Statistics/Random Processes/ Probability	• See *Statistical Analysis*.

Graphing/Functions	• See *Graphing*.
Fraction/Ratio	• See *Computation Using Operations: Fractions/Ratios/Percentages*.
Maximum and Minimum Values	• Using as few characteristics as possible to successfully describe a student. • Finding the minimum number of characteristics that will successfully describe 80% of the students.
Equivalence/Inequality/ Equations	• See *Comparing* and *Computation Using Operations*.
Set Theory	• See *Classifying/Categorizing*.

ACTIVITIES IN DESCRIBING PEOPLE UTILIZING SCIENCE

Process	
Observing/Describing	• Observing and describing accurately like and differing physical characteristics. • Observing variations within categories of a characteristic, e.g., different shades of brown hair. • See also SOCIAL SCIENCE list: *Observing/Describing/ Classifying.*
Classifying	• Classifying physical characteristics, e.g., permanent and changeable characteristics, relevant and irrelevant characteristics. • Classifying physical characteristics in more than one way, e.g., a relevant and changeable characteristic. • See also MATHEMATICS list: *Classifying/Categorizing* • See also SOCIAL SCIENCE list: *Observing/Describing/ Classifying.*
Identifying Variables	• Identifying height, weight, hair color, eye color, skin color, sex as things that can change from one person to another. • Identifying variations within categories of characteristics, e.g., different shades of brown color hair, different heights in the "tall" category for height. • Identifying variations in measurement data due to measuring instrument variations. • See also SOCIAL SCIENCE list: *Identifying Problems, Variables.*
Defining Variables Operationally	• Defining height categories (tall, medium, short) according to height measurement distribution in the sample population. • Defining an effective characteristic as one that will not change daily, e.g., permanent characteristic. • Defining a distinctive characteristic as one that few other people possess. • Defining an effective description as one that identifies the correct student 80% of the total trials.

Manipulating, Controlling Variables/Experimenting

- Conducting trials of descriptions varying the characteristics and the number of characteristics used.
- Using different ways to test descriptions, e.g., Sit-Down Game, identifying a student in another room, Rope Circles Game.
- Measuring one distance using different measuring instruments.
- See also SOCIAL SCIENCE list: *Manipulating, Controlling Variables/Experimenting.*

Designing and Constructing Measuring Devices and Equipment

- Constructing measuring instruments (e.g., calipers) in the Design Lab.

Inferring/Predicting/Formulating, Testing Hypotheses/Modeling

- Predicting that some characteristics will be less effective than others in identifying students.
- Formulating and testing the hypothesis that 80% of the students in a class can be identified correctly by using only four characteristics in a description.
- Modeling the outcome of a Sit-Down Game by constructing a Venn diagram.
- Using a scatter graph to predict whether a person is fat, medium, or thin.
- Testing descriptions using the Sit-Down Game, identifying a student in another class, etc.
- See also SOCIAL SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*

Measuring/Collecting, Recording Data

- Using standard (centimeters, inches, pounds) and non-standard (string lengths) units of measure.
- Using different measuring instruments to gather body measurements, such as tape measures, meter sticks, calipers, weight scales.
- Reading measuring instruments accurately.
- Recording body measurements in an organized manner.
- See also MATHEMATICS list: *Measuring.*
- See also SOCIAL SCIENCE list: *Collecting, Recording Data/Measuring.*

Organizing, Processing Data

- Arranging measurement data in an organized manner, e.g., ordering the height data from tallest to shortest; organizing weight data by grade level and sex.

Organizing, Processing Data (cont.)

- See also MATHEMATICS list: *Organizing Data.*
- See also SOCIAL SCIENCE list: *Organizing, Processing Data.*

Analyzing, Interpreting Data

- Comparing a description's effectiveness (number of successful trials to total number of trials) under different situations, e.g., Sit-Down Game vs. finding a student in another class.
- See also MATHEMATICS list: *Comparing; Statistical Analysis; Graphing; Maximum and Minimum Values.*
- See also SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*

Communicating, Displaying Data

- Representing quantitative and qualitative data on graphs or charts.
- Reporting data to the class.
- See also MATHEMATICS list: *Graphing.*
- See also SOCIAL SCIENCE list: *Communicating, Displaying Data.*
- See also LANGUAGE ARTS list.

Generalizing/Applying Process to New Problems

- Recognizing that classroom furniture and fixtures in the various grade levels are different sizes and heights because of physical differences.
- Using acquired knowledge of the scientific inquiry process (e.g., identifying a problem, identifying important aspects of the problem, etc.) to tackle other real problems, e.g., other USMES challenges.
- See also SOCIAL SCIENCE list: *Generalizing/Applying Process to Daily Life.*

Areas of Study

Measurement

- Understanding the concept of a unit of measure.
- Using standard (centimeters, inches, pounds) and non-standard (string lengths, hand spans) units of measure.
- Using different measuring instruments to measure various body parts, meter stick to measure height, balance scale to measure weight.
- Reading measuring instruments correctly.
- Recognizing that repeated measurements of a distance produces a distribution, rather than one value.

Measurement (cont.)	• Recognizing whether a measurement is valid or not, e.g., height measurements of students with and without shoes. • See also MATHEMATICS list: *Measuring*.
Force	• Observing the differences between power and manual tools when making measuring instruments in the Design Lab. Observing that power tools multiply force or increase speed.
Mechanical Work and Energy	• Noting that work is done and energy is expended when hammering nails into wood. • Observing that wood becomes warm when sanded vigorously as mechanical energy is transformed into heat energy. • Observing that saber saws are faster than hand saws for cutting Tri-Wall or lumber. Noting that power tools transform electrical energy into mechanical energy.
Solids, Liquids, and Gases	
States of Matter	• Observing that glue is available in liquid or solid form with different properties. • Observing that a solid stick of glue is turned into hot liquid glue by using a hot glue gun.
Properties of Matter	• Observing that different construction materials, such as lumber and Tri-Wall, have different properties that make them useful for different tasks. • Observing the effects of physical wear on the instruments. • Observing that glues, lumber, paper and other materials have particular odors.
Genetics/Heredity/Propagation	• Examining differences and similarities in physical characteristics between children and their parents. • Distinguishing between inherited and changeable characteristics. • Noting that physical characteristics are inherited from parents.

Anatomy/Physiology

- Observing bone structures and body proportions and noting that big-boned children may be the same height as small-boned children.
- Observing differing and like physical characteristics.
- Measuring height and weight.

ACTIVITIES IN DESCRIBING PEOPLE UTILIZING SOCIAL SCIENCE

Process

Observing/Describing/Classifying	• Observing variations among people, especially physical characteristics. • Compiling an exhaustive list of all possible ways to describe people. • Using accurate words to describe physical characteristics. • Classifying people in one or more ways, e.g., by age, sex, grade level, race. • Noting and comparing the different ways that agencies, such as the Federal Bureau of Investigation, bureau of missing persons, describe people. • See also MATHEMATICS list: *Classifying/Categorizing.* • See also SCIENCE list: *Observing/Describing; Classifying.*
Identifying Problems, Variables	• Identifying the problem of trying to find a description that will single out one student. • Identifying variations in student opinion of what is a good characteristic to include in a description. • Identifying variations in student opinions of various characteristics, e.g., brown hair for hair color, tall, medium, short for height. • See also SCIENCE list: *Identifying Variables.*
Manipulating, Controlling Variables/Experimenting	• Testing the reliability of categories of characteristics, e.g., brown, blond, black hair color, through student opinion survey. • Standardizing measuring methods among the students. • See also SCIENCE list: *Manipulating, Controlling Variables/Experimenting.*
Inferring/Predicting/Formulating, Testing Hypotheses	• Inferring from the histogram on height that there are more tall than short students in the class. • Predicting that some students will be more difficult than others to single out due to similarities of characteristics. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses /Modeling.*

Collecting, Recording Data/ Measuring	• Conducting an opinion survey to determine how each student sees himself in terms of height, weight, hair color, eye color. • Collecting and recording qualitative data, e.g., hair color, eye color, skin color. • See also MATHEMATICS list: *Counting; Measuring.* • See also SCIENCE list: *Measuring/Collecting, Recording Data.*
Organizing, Processing Data	• Tallying and counting number and variety of characteristics used in descriptions. • Tallying and counting the number of characteristics needed to identify a student. • Tallying opinion survey data on physical characteristics. • Ordering data in terms of some defined criterion, such as ordering groups of characteristics in order of importance, effectiveness, etc.
Analyzing, Interpreting Data	• Comparing qualitative information gathered from various sources, e.g., comparing the ways the Federal Bureau of Investigation and the bureau of missing persons describe people, comparing hair colors from different students. • Comparing student heights or weights by putting students back to back or side by side. • See also MATHEMATICS list: *Comparing; Statistical Analysis; Graphing; Maximum and Minimum Values.* • See also SCIENCE list: *Analyzing, Interpreting Data.*
Communicating, Displaying Data	• Reporting group activities to the class. • See also MATHEMATICS list: *Graphing.* • See also SCIENCE list: *Communicating, Displaying Data.* • See also LANGUAGE ARTS list.
Generalizing/Applying Process to Daily Life	• Using one's knowledge of describing people to help identify or describe people in various situations, e.g., finding a student or a teacher during a school assembly. • See also SCIENCE list: *Generalizing/Applying Process to New Problems.*

Attitudes/Values

Accepting Responsibility for Actions and Results	• Performing small group tasks, e.g., collecting hair color samples, measuring weights. • Arranging a schedule with other classes, e.g., to measure students, to identify a student in another class. • Scheduling and giving a presentation to others to share ways of describing people.
Developing Interest and Involvement in Human Affairs	• Seeking an effective and efficient way to describe people so that they can be easily identified.
Recognizing the Importance of Individual and Group Contributions to Society	• Recognizing that their ability to describe people will assist others in finding people.
Developing Inquisitiveness, Self-Reliance, and Initiative	• Conducting group sessions with some teacher assistance. • Learning to use different ways of obtaining needed information, e.g., letter writing, using the telephone. • Increasing knowledge of possible resource places, e.g., library, police station. • Resolving problems that arise in addition to the overall challenge problem, e.g., deciding how to standardize some of the characteristics like tall, medium, short for height.
Recognizing the Values of Cooperation, Group Work, and Division of Labor	• Recognizing the efficiency that small group work provides, e.g., in collecting numerous body measurements. • Finding that work proceeds smoothly when everyone cooperates.
Understanding Modes of Inquiry Used in the Sciences, Appreciating Their Power and Precision	• Identifying and defining the problem; being able to distinguish it from related but secondary problems. • Identifying important aspects of the problem and setting priorities. • Determining the best way to collect measurement data. • Formulating a testable description and testing it by trying to find a student in another class. • Using charted and graphed data to support their suggested ways of describing people. • See also MATHEMATICS and SCIENCE lists.

ACTIVITIES IN DESCRIBING PEOPLE UTILIZING LANGUAGE ARTS

Basic Skills

Reading: Literal Comprehension--Decoding Words, Sentences, and Paragraphs	• Decoding words while reading descriptions. • Decoding words, sentences, and paragraphs while reading articles and posters on ways the Federal Bureau of Investigation or the bureau of missing persons describe wanted or missing persons.
Reading: Critical Reading--Comprehending Meanings, Interpretation	• Reading newspaper articles on missing persons and noting ways the persons were described. • Evaluating drafts of letters.
Oral Language: Speaking	• Offering ideas, suggestions, and criticisms during class discussions on which characteristics to include in a description. • Reporting to class on procedures used to measure height, weight. • Reading descriptions aloud. • Making arrangements with other teachers in the school to test descriptions in their classes. • Using rules of grammar in speaking.
Oral Language: Listening	• Listening to other students' ideas, suggestions, and criticisms during class discussions on descriptions. • Listening to descriptions as they are read aloud while playing the Sit-Down Game. • Following spoken directions, such as directions to play the Sit-Down Game.
Written Language: Spelling	• Using correct spelling in writing descriptions. • Using correct spelling in writing letters to various agencies to share their ways of describing people.
Written Language: Grammar--Punctuation, Syntax, Usage	• Using rules of grammar in writing letters to various agencies to share their ways of describing people.

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Written Language: Composition	• Writing to communicate effectively: preparing letters using notes and graphs. • Communicating ways to describe people to other students in the school.
Study Skills: Using References and Resources	• Using the bureau of missing persons or the Federal Bureau of Investigation as resources. • Using "How To" Cards for information on graphing.
Study Skills: Outlining/Organizing	• Organizing descriptions in order of effectiveness. • Planning and preparing drafts of letters for review by the class before final copy is written. • Organizing data for inclusion in a letter.

Attitudes/Values

Appreciating the Value of Expressing Ideas Through Speaking and Writing	• Realizing that sharing their way of describing people may help others.
Appreciating the Value of Written Resources	• Finding that certain desired information can be found in written resources, such as newspaper articles, posters, books.
Developing an Interest in Reading and Writing	• Showing a continued interest in ways others describe people in newspaper articles, magazines and books.
Making Judgments Concerning What is Read	• Deciding how much of what is read on a Federal Bureau of Investigation bulletin is applicable to their problem of finding a good description.
Appreciating the Value of Different Forms of Writing, Different Forms of Communication	• Finding that descriptions should be written down so that they can be referred to at a later time. • Finding that spoken instructions are sometimes better than written instructions, and vice versa.

Respecting the Views, Thoughts, and Feelings of Others	• Considering all suggestions and ideas and assessing their merit. • Recognizing differences in values according to age, experience, occupation, income, and interests (culture, race, religion, ethnic background).
Being Open to New Ideas and Information	• Considering suggestions and ideas from all students, considering other ways of doing various tasks. • Recognizing the importance of information obtained from different sources, e.g., library, police station, newspaper.
Learning the Importance and Influence of Values in Decision Making	• Recognizing that opinion differences reflect value differences.
Areas of Study	
Sociology/Social Systems	• Devising a system of working cooperatively in small and large groups. • Recognizing that there are many different social groups and that one person can belong to more than one social group.
Social Psychology/Individual and Group Behavior	• Recognizing that physical characteristics may unduly influence an individual's self-image and behavior towards others. • Respecting everyone's different physical characteristics.
Recent Local History	• Investigating previous attempts to identify people, characteristics used and success ratio.